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THE PSYCHOLOGIST'S FRAME OF REFERENCE¹

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For the first time in the forty-seven years of its history this Association has elected to assemble on the coast of the Pacific. This meeting at two great centers of learning and research is not only proof of the ocean-to-ocean sweep of our membership, of our influence and prosperity, but may be taken to symbolize as well the westward trek of culture in America; or to those who like epic perspective, it may signify the westward march of Mind from Asia, to Europe, to America. But whether we think in terms of historical symbolism or not, we can hardly deny, at a time when heavy darkness has descended over the European continent, that this Forty-seventh Annual Meeting finds the burden of scientific progress in psychology resting as never before upon the membership of this Association. Fortunate we are in assuming this burden to have the support of gifted émigrés who have come so recently to join their strength to ours.

With the responsibility for the preservation and eventual rehabilitation of world psychology falling upon our shoulders, we do well to examine our credentials. Are we American psychologists equipped for the versatile leadership demanded by our comprehensive discipline; are we prepared to develop the potentialities of all its parts? These are not rhetorical questions but questions of such immediate, practical import for our science that I propose from this unusual vantage point today to seek answers as definite and unequivocal as possible. By charting the course American psychology has taken in its recent past we can determine whether the signs we observe augur the wholesome growth of psychology under our leadership and the extension of its beneficial influences to humanity at large.

¹ Presidential address delivered at the Forty-seventh Annual Meeting of the American Psychological Association, Berkeley, California, September 7, 1939.

FIFTY YEARS OF CHANGE

Since psychology is whatever competent psychological workers make of it, I am asking, first, what it is that competent psychologists in America have been making of our science in the past fifty years, and seek to answer the question by the well-known method of combining our professional journals.

Thirty colleagues rated fifty journals according to their significance for, and devotion to, the advancement of psychology as science. The fourteen journals at the top of the list were chosen for analysis. For every tenth year, beginning 1888 and ending 1938, the entire periodical literature of these fourteen journals was read and analyzed.² To be sure, only two journals extend as far back as the decade beginning 1888,³ and some of them did not come into existence until 1938. Yet, if the sample is smaller for the earlier years, it is likewise more exhaustive, since virtually no periodicals were omitted from the earlier years.

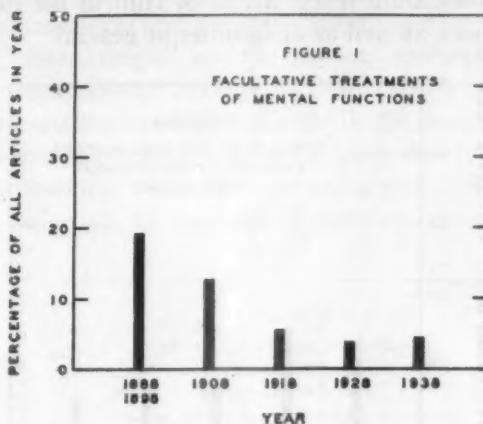
The selected journals contained over sixteen hundred articles in all, each of which was read and fitted to a system of thirty-two rubrics. Since many of these rubrics, especially those pertaining to the theoretical predilections of the authors of the articles, required subjective judgment, for a generous sample of the material independent judgments were secured from two classifiers. Mr. Jerome Bruner was my collaborator, and our agreement for all our separate judgments was 91%. At a later date the results of our analysis will be published in detail (9). For my purposes this afternoon a few of the most representative results will serve.

First, we note the decline in "facultative" treatments of mental functions. Figure 1 reflects the diminution in the *deus ex machina* type of explanation. Owing to the fewness of cases in the earlier years, we combine 1888 and 1898, and find that 19% of all articles in these years lean for their interpretation upon instinct, the "power" of attention, synthetic apperceptive unity, and kindred concepts. In successive years the falling off is gradual but almost complete. Off-

² The journals were the *Psychological Review*; *Journal of Experimental Psychology*; *American Journal of Psychology*; *Journal of Abnormal and Social Psychology*; *Journal of General Psychology*; *Psychological Bulletin*; *Journal of Psychology*; *Pedagogical Seminary* and *Journal of Genetic Psychology*; *Journal of Social Psychology*; *Character and Personality*; *Journal of Educational Psychology*; *Psychometrika*; *Journal of Comparative Psychology*; *Journal of Applied Psychology*.

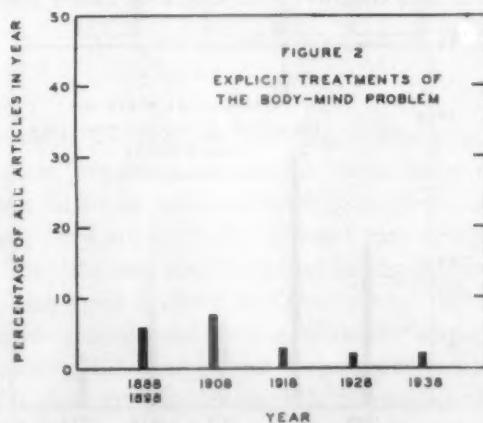
³ The *Psychological Review*, founded 1888, and the *Pedagogical Seminary*, founded 1891.

setting it in part, however, is the rise of a modern facultative treatment, different in terminology, but kindred in spirit. Here we place some of the contributions, though by no means all, that deal with



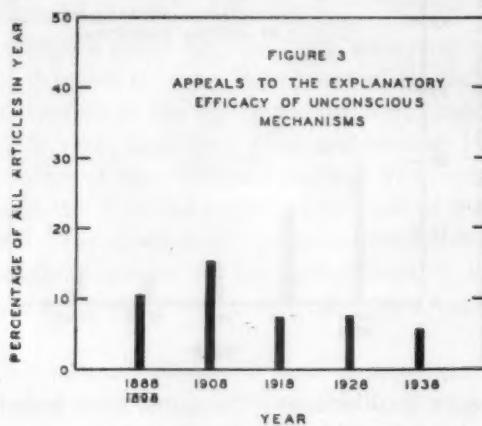
factors, abilities, or the libido, as if they, too, were gods of a machine. On the whole, however, this latter tendency is not marked.

Another declining interest, so far as its explicit treatment in periodical literature is concerned, is the body-mind problem. Figure 2

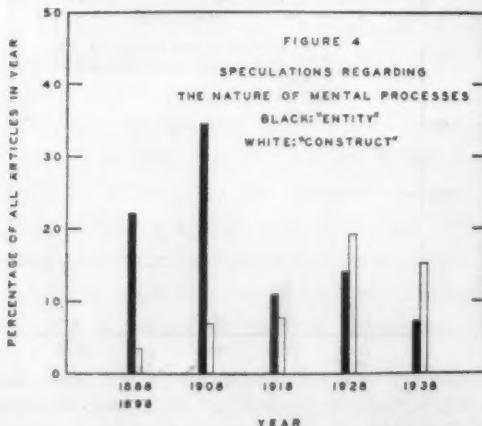


shows the irregular decline. To a certain extent, however, this figure masks a significant shift in viewpoint. In the earlier literature solutions to the problem were boldly offered in monistic or dualistic terms; today the fashion is to deny the existence of the body-mind problem, the denial being generally effected with the aid of Vienna logic.

Figure 3 demonstrates the rise and fall of the unconscious. True, psychoanalytic journals are not included in our survey, but the point is here established that the principal periodicals written and read by our own Association reflect a loss of faith in the causal efficacy of the unconscious as well as of faculties in general.



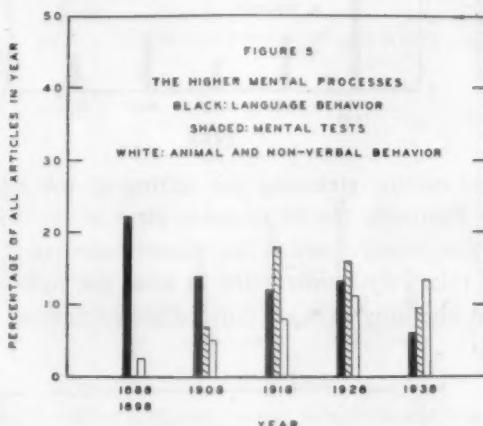
Another decreasing interest is in speculation concerning the true and essential nature of this or that mental process. The two parts of Figure 4 bring into contrast what might be called *process as entity*



and *process as construct*, or the "realistic" view of the nature of process versus the "nominalistic" view. Nowadays we care less than formerly what the *nature* of "intelligence," "learning," "atten-

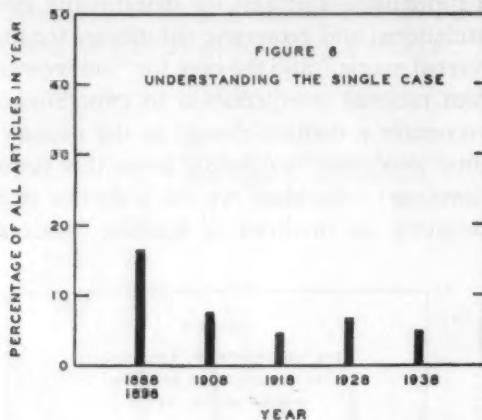
tion," or "drive" may be, but at the same time we care more about avoiding the hypostatization of mental processes. In the white bars are entered all articles dealing with what might broadly be called methodological formalism—methods for determining constructs from operations, postulational and geometric substitutes for mental entities, criticisms of "verbal magic," and the case for "intervening variables."

Turning from rational interpretation to experimental studies, in Figure 5 we encounter a distinct change in the manner of attacking the higher mental processes (excluding from this count perception, but including learning). In black we see a decline in studies based on language behavior, as involved in learning, reasoning, concept-

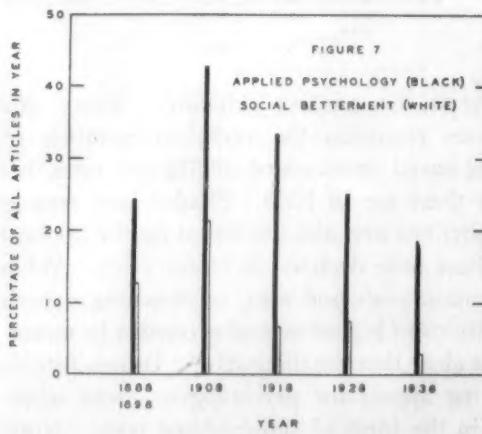


formation, reverie, or creative thinking. Every study of higher mental processes requiring the verbal coöperation of the subject, excepting those based on standard intelligence tests, is here included. Note how few there are in 1938. Shaded bars represent all studies of cognitive functions and abilities based on the application of mental tests. Even these have declined in recent years. White bars include maze learning in animals and men, conditioning experiments, and all other investigations of higher mental processes by means of non-verbal methods. It is clear that the distinctively human function of language has a decreasing appeal for psychologists, even when the language expression is in the form of standardized tests. Note that the only increase is in those studies of higher mental processes conducted with animal subjects or with human subjects who for the duration of the experiment are rendered totally speechless.

Interest in the single case has also lessened. Included in Figure 6 are articles directed toward the understanding of the individual event, based upon intensive studies of clinical cases, individual persons, or

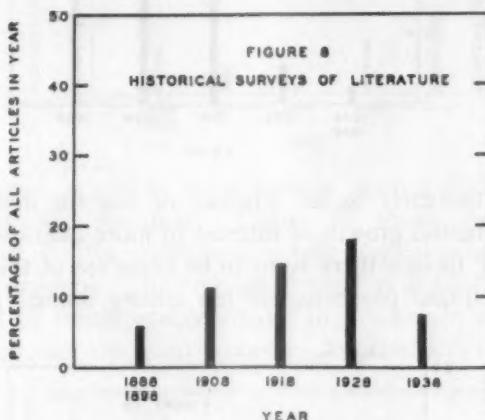


single historical events, stressing the setting of the case in its life-environment. Formerly the idiographic view of the single case was fairly popular; in recent years it has almost been ruled out of court. We seem now relatively uninterested in what the individual case can teach us, or in checking our scientific schemes against the obdurate concrete event.



In Figure 7 we see a decline in the percentage of contributions dealing with applied psychology as well as of those concerned with social betterment. In view of the flourishing activity of the American Association for Applied Psychology and the Society for the Psychological Study of Social Issues, it is surprising to find a distinct

falling off in articles applying psychology to life or pointing it in the interests of social amelioration. The conclusion to be drawn, I think, is not that our membership as a whole is less interested in the usefulness of psychology, but that a certain professional cleavage is developing. Psychologists using the fourteen journals studied are, in their writings, becoming more and more remote from living issues and more abstract in the presentation of their subject matter. The consulting, applied, and socially-minded psychologists are turning to other, more specialized, journals not included within our survey. Thus, the indication is that "pure" and "applied" psychology are

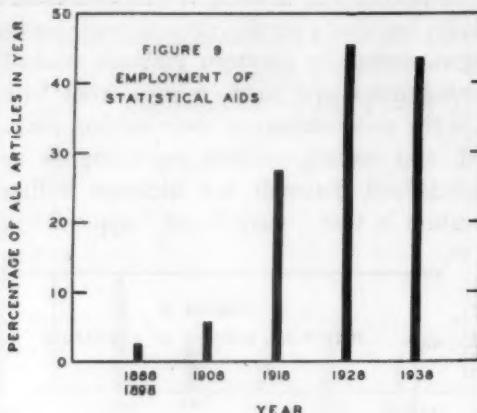


parting ways to some extent—an event which some will deplore and others welcome.

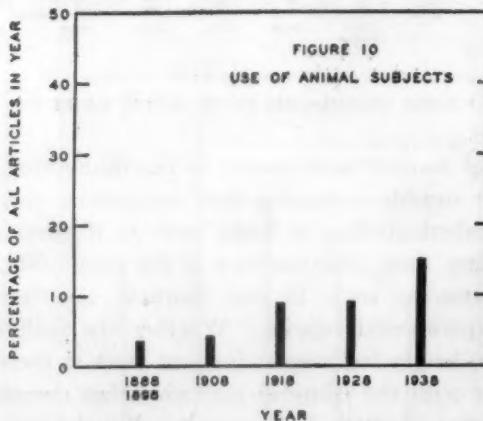
A decline of another sort is seen in the diminution of historical surveys. After steadily increasing their recognition and acknowledgement of antecedent studies, it looks now as if psychologists have started to declare their independence of the past. There are fewer historical reviews, as such, in our journals, and fewer historical preludes to experimental reports. Whether the fault lies with the authors who no longer feel respect for past work in their special lines of research, or with the editorial guillotine that decapitates articles to fit our crowded journals, I cannot say. But the fact remains that as research accumulates in our archives it is cited less frequently in our current publications.

Turning from negative to positive trends, we find, first, striking evidence of the increased use of statistical aids in the treatment of research data. Formerly, statements of central tendency were sufficient. Nowadays, measures of range, variability, correlation, and still more elaborate quantitative treatment of data are increasingly

employed, until nearly half of all our periodical literature shows dependence upon them.

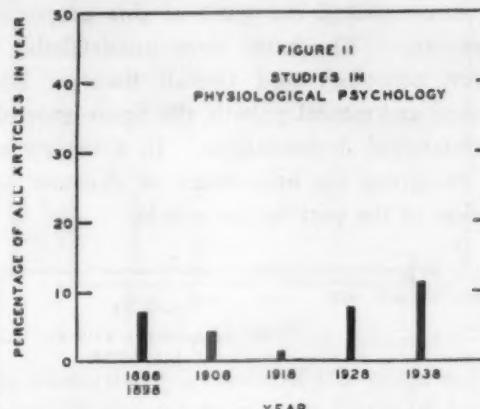


It is still too early to tell whether or not the decline in 1938 reflects a substantial growth of interest in more intensive work with fewer subjects, though there seem to be promises of this change not only among clinical psychologists but among animal psychologists as well.

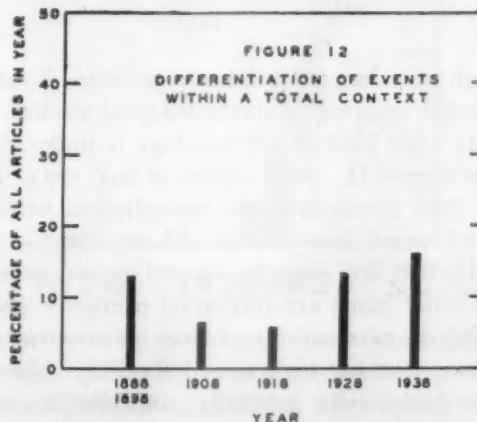


Another decidedly upward trend is the use of animal subjects in psychological research. In 1888 and 1898, taken together, only 3.5% of all studies employed animals—and this always with the intent of finding out how animals *as animals* behave; whereas last year over 15% of all articles were based upon investigations with animals and with no such modest expectation. Today it seems animals are not studied for their own sakes, but rather for what Fabre, the naturalist,

called the "universal psychology" revealed by all animals from insects to *Homo sapiens*.



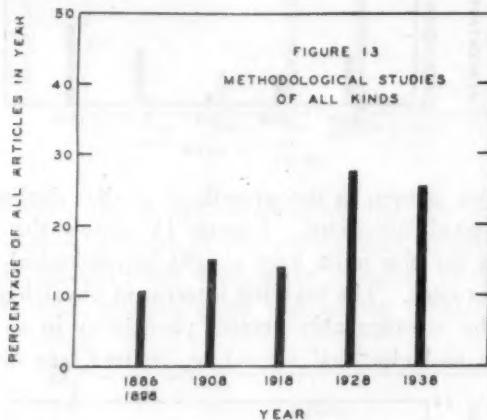
Another rise is seen in the growth of studies dealing specifically with physiological functions. Figure 11 shows the trend. The earlier studies for the most part sought physiological correlates of conscious experience. The reviving interest in physiological research, accompanied by incomparably greater proficiency in such techniques as extirpation and electrical recording, centers less often upon the



parallelism of bodily functions and experience, but studies bodily functions directly in a manner that makes the line between psychophysiology and physiology increasingly difficult to draw.

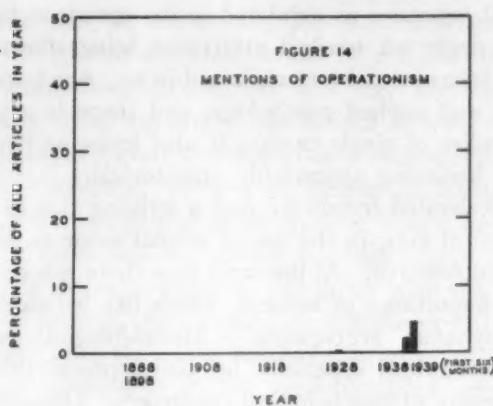
Somewhat more elusive for classification is the growing tendency to regard processes or events as differentiated within a total context. Figure 12 shows a decline and rise in this point of view. Most of

the earlier entries did mere lip-service to the proposition that all factors in the total situation must be considered. Only a few of them actually demonstrated the truth of this proposition as recent researches have done. The latter show unmistakably the influence of both modern neurology and Gestalt theory. Entries include studies of physical and mental growth, the figure-ground relationship, field theory, situational determination. In a variety of ways these investigations recognize the importance of dynamic segregation, of the determination of the part by the whole.

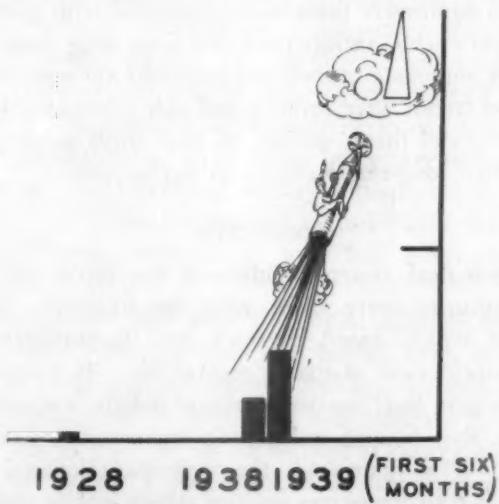


Next, though in a way the point is repetitious, I call your attention to the general upswing in methodological studies. Making no distinction as to what kind of methodology is under discussion, we see the trend in Figure 13. As a matter of fact, the earlier methodological articles dealt chiefly with the metaphysical nature of psychological data and asked how we should set about our studies of attention, intelligence, and thought, viewed as real processes. Later studies, on the other hand, are concerned primarily with getting rid of entities, giving the necessary arguments for constructs, intervening variables, rational learning curves, and the like. More specifically, the modern methodologists generally subscribe to some form of logical empiricism, increasingly to operationism.

Concerning operationism itself, the term, though new, has a special lure. Figure 14 shows its upward path. In 1928, close on the heels of Bridgman's book, one article mentioning operationism appeared. To bring the trend to date, the percentage for the first six months of 1939 has been added.



A close-up shows that the course of this magic concept is onward and upward, leading somewhere into the world of tomorrow.



Such are some of the waxing and waning fashions of the day. The story is incomplete, but even from the few points just plotted, we can draw a significant perspective. Reviewing the evidence, we find mental faculties and hypostasized psychic processes vanishing rapidly, though here and there still masquerading behind new terms. The body-mind problem, never solved, has been declared popularly null and void. Dualism evokes rejection responses of considerable vehemence. (Indeed, of all philosophical pollens, psychologists seem most allergic to this.) The appeal of the unconscious is dwindling.

Higher mental processes as exhibited in the speech of human beings are relatively neglected, marked preference being shown for studies of non-verbal behavior and for animal subjects. A schism is apparent between pure and applied psychology, and there is a growing disregard for studies of single cases. It also looks as if modern psychology were becoming appreciably unhistorical.

Among accelerated trends we find a striking rise in the employment of statistical aids, in the use of animal subjects, in the spread of physiological research. At the same time there is a growing recognition of the importance of context, which has led to many fruitful studies of dynamic segregation. Methodological studies have mounted, characterized especially by philosophical theorizing concerning the nature of psychological constructs. Operationism is the current watchword of an austere empiricism. Synoptic systems, such as those of McDougall and Stern, have given way to miniature systems, and embracing theories expounded in the grand manner have yielded to diminutive theories implemented with great precision. Immediate experience is rigidly excluded from most modern systems, and in its place surrogate operational functions are sought. Needless to say, all these trends have staunch and able advocates, but our task today is not to extol them—rather, to view them in perspective and to anticipate their long-range effects on our science.

PERSPECTIVE

The psychological system-builders of the Nineteenth and early Twentieth Centuries were filled with the lingering spirit of the Enlightenment which hated mystery and incompleteness. They wanted a synoptic view of man's mental life. If moral and metaphysical dogmatism were needed to round out their conception of the complete man, they became unblushing dogmatists. Yet even while their synoptic style flourished, the very experimental psychology which they helped to create was leading others into new paths. Their own students, in the very process of enhancing their experimental proficiency, came to admire not the work of their masters, but the self-discipline of mathematics and of the natural sciences. Willingly they exchanged what they deemed fruitless dialectics for what to them was unprejudiced empiricism. Nowadays, for one experimentalist to proclaim another "superior to controversy about fundamentals" is considered high tribute (8, p. 133).

There are with us still, of course, stubborn apostles of the Enlightenment who have not been pleased with this turn of events.

They complain that we are putting too little architectonic into our work; that, though not everyone should be a myth maker, we must have a few whose weighty influence will keep the rest of us keyed to the necessity of seeing larger significance in what we do. They say we have become a craft overstuffed with techniques and that, preoccupied with minutiae, we are in danger of losing perspective. They even say that Leipzig in labor brought forth a mere mouse (36, p. 429). But the modernist says *à bas!* with such nostalgia, and down, too, with synoptic systems, and down with the dated subjective categories derived from immediate experience that are invoked to sustain these systems. We will have no more of them!

Fierce and portentous is the modern attack upon immediate experience.⁴ While it is commonly granted that the immediate experience of the investigator is the source of the subject matter of psychology, as of all other sciences, yet it is said that like the older sciences psychology should instantly supplant this direct experience by indirect objective formulations. Subjective immediatism must give way to a public outdoor attitude toward our knowledge. It is said that the very claim made by some psychologists that their work remains true to life, close to untrammeled common sense, is the very thing that disqualifies this work from being scientific (26, p. 178). There is no need for a curve of sensory intensity to *feel* like sensory intensity, for the obstruction method to *feel* like a desire, nor for a curve of conforming behavior to look like a crowd at a traffic intersection (19, p. 33).

So it comes about that after the initial take-off we, as psychological investigators, are permanently barred from the benefit and counsel of our ordinary perceptions, feelings, judgments, and intuitions. We are allowed to appeal to them neither for our method nor for our validations. So far as *method* is concerned, we are told that, because the subject is able to make his discriminations only after the alleged experience has departed, any inference of a subjectively unified experience on his part is both anachronistic and unnecessary (6). If the subject protests that it is evident to him that he had a rich and vivid experience that was not fully represented in his

⁴ A full explanation of this attack would have to include an account of many influences, among them (a) long frustration with the body-mind problem, (b) cumulative attacks upon the reliability of introspection, (c) imitative strivings after the "monism" of the natural sciences, (d) slight success in empirical studies of thinking, reasoning, volition, (e) correspondingly greater (felt) success with animal experimentation.

overt discriminations, he is firmly assured that what is vividly self-evident to him is no longer of interest to the scientific psychologist. It has been decided, to quote Boring, that "in any useful meaning of the term existence," "private experience does not exist" (7).

When it comes to validating his work, the modernist follows a logic all his own. He certainly implies that his findings overspread the problem initially formulated from experience—that thresholds of discrimination correspond to thresholds of consciousness,⁵ that crossings of a grid correspond to desire, and that PGR deflections correspond to felt emotions. But should he return to the initial experience from which he started in order to validate or to apply these findings, he would probably be startled—even as the layman is startled—by the grotesque lack of fit. Fortunately for him, however, his creed forbids him to consult more than his skeletonized operations—the full-bodied experience he started with is never appealed to.

The consequences of the raid on immediate experience have already been shown in the graphs: disbelief in the existence or approachability of mental processes as such, a flight from linguistic functions, loss of interest in the single case, as well as in the historical background of psychology, and at the same time the development of a notable schism between the psychology constructed in a laboratory and the psychology constructed on the field of life.

An increasing number of investigators now pin their faith upon experimentation with animals. Our program tells us that 25% of the papers delivered at this year's meetings are based upon animal research. In 1914, twenty-five years ago, the corresponding percentage was 11.

A colleague, a good friend of mine, recently challenged me to name a single psychological problem not referable to rats for its solution. Considerably startled, I murmured something, I think, about the psychology of reading disability. But to my mind came flooding the historic problems of the aesthetic, humorous, religious, and cultural behavior of men. I thought how men build clavichords and cathedrals, how they write books, and how they laugh uproariously at Mickey Mouse; how they plan their lives five, ten, or twenty years ahead; how, by an elaborate metaphysic of their own contrivance, they deny the utility of their own experience, including the utility of the metaphysic that led them to this denial. I thought of poetry and puns, of propaganda and revolution, of stock markets and

⁵ A point concerning which J. G. Miller's experiment has raised considerable doubt (23).

suicide, and of man's despairing hope for peace. I thought, too, of the elementary fact that human problem-solving, unlike that of the rat, is saturated through and through with verbal function, so that we have no way of knowing whether the delay, the volition, the symbolizing and categorizing typical of human learning are even faintly adumbrated by findings in animal learning.⁶

One should not prejudge this issue; but before we wander much farther down the road we are traveling might we not with profit hold a symposium for the purpose of discovering to what extent infrahuman analogues have given us power to predict, understand, and control human behavior? It is not, of course, a question of the parallels from anatomy and physiology obviously valuable for medical science, but of parallels in gross molar conduct applicable in a sphere where the culture and peculiar genius of humanity prevail. We need to ask ourselves point-blank whether the problems we frame with our rats are unquestionably of the same order as the problems we envisage for human kind; and further, if we succeed in solving a problem for rats, how we are to make sure the findings hold for man unless we repeat the whole investigation on man himself; and if we are forced to verify our principles by a separate study of man, whether we have the right to inveigh against the psychologist who prefers to study human manners and morals, since it is upon his work that the validation of our own will ultimately rest.

At the present time there can be little doubt that it is not altogether the demonstrated value of animal research that accounts for its vogue, but in large part its delightful suitability for the exercise

⁶ In a valuable paper on the experimental analysis of instinctive behavior K. S. Lashley tells of the activity of the microstoma, a tiny marine worm, that, having no stinging cells of its own, captures and ingests hydras that have, until it is sated and has incorporated in itself the nettles it needs for its own protection. Regarding this remarkable performance Lashley has written: "Here, in the length of half a millimeter, are encompassed all of the major problems of dynamic psychology. There is a specific drive or appetite, satisfied only by a very indirect series of activities, with the satisfaction of the appetite dependent upon the concentration of nettles in the skin" (20, p. 446). One wonders whether the only major problems of dynamic psychology are those having to do with specific drive and its satisfaction through an indirect series of activities performed by an uncorticated organism. Does a cortex bring no major problems of its own? Are symbols, dreams, autism, unreality, guilt feelings, the ego ideal, of no essential significance? Does culture create no major problems for dynamic psychology? And has the microstoma, one wonders, that curious type of scientific motivation that requires it to view itself as a mechanism devoid of immediate experience and volition?

of objective and approved methods. By studying rats, not men, we gain status as scientists, for like the natural sciences we can, in this line of investigation, employ precision techniques and operational modes of communication. This desire for status on our part is understandable, but because of it we are in danger of losing sight of the true source of the eminence of the elder sciences. Their enviable glory does not consist in their fidelity to a set of conventional methods, but rather in the unexampled power they have given mankind in *predicting, understanding, and controlling* the course of nature for mankind's own benefit. As a mature science psychology, too, will find its justification, not in performing a ritual of method, but in contributing to humanity the power to achieve these ends.

PREDICTION

Considering, then, man's interest in his own well-being, let us ask how matters stand with psychological prediction. Is it not true that apart from a narrow range of segmental reactions in the laboratory we psychologists can predict very little concerning human conduct? It is argued, of course, that sophistication in methodology will improve matters. Yet there are two grounds for doubting this claim. First, since the current methodological trend will not take direct experience as a model for its constructs nor return to it for a validation of its results, it seems unlikely that the utility of its predictions will be great. Or to state the point affirmatively, in order to predict events of pressing significance for human life one must *deal* with these events (not with some simplified surrogate or analogue), studying them at a suitable level of complexity and checking one's predictions by the actual lives men lead.

The second ground for misgiving lies in the fact that the modern methodologist, no less than his predecessors throughout the history of psychological science, fails to see the peculiar need in psychology for the prediction of the individual event. Of the two kinds of prediction appropriate to psychology—the actuarial and the individual—the former only, up to now, has received the attention it deserves.

Suppose we set out to discover the chances of John Brown to make good on parole, and use for the purpose an index of prediction based upon parole violations and parole successes of men with similar histories. We find that 72% of the men with John's antecedents make good, and many of us conclude that John, therefore, has a 72% chance of making good. There is an obvious error here. The fact that 72% of the men having the same antecedent record as John

will make good is merely an actuarial statement. It tells us nothing about John. If we knew John sufficiently well, we might say not that he had a 72% chance of making good, but that he, as an individual, was almost certain to succeed or else to fail. Indeed, if we believe in determinism at all, his chances are either zero or else 100; he is bound to succeed or else to violate because the germs of his future are already contained in his attitudes, in the meaning to him of his antecedent life, and in the specific psychological environment that molds him. Even admitting the possibility of unforeseeable accidents, as scientific determinists we ought to strive for a prediction more accurate than the senseless 72% that is derived from a table of norms based on the antecedents of paroled men *en masse*. Or again, if seven in ten Americans go to the movies each week, it does not follow that I have seven in ten chances of attending. Only a knowledge of *my* attitudes, interests, and environmental situation will tell you my chances, and bring your prediction from a 70% actuarial statement to a 100% certain individual prediction.

The upshot of the matter is this: psychology will become *more* scientific, *i.e.* better able to make predictions, when it has learned to evaluate single trends in all their intrinsic complexity, when it has learned how to tell what will happen to *this* child's IQ if we change his environment in a certain way, whether *this* man will make a good executive, whither *this* social change is tending.

For certain purposes actuarial predictions have their uses. They are based on the type of law that transcends geographical-historical context. Yet in many cases we find that human conduct is so utterly modified by geographical-historical context, and by all concurrent internal trends accompanying the behavior in question, that laws ignoring context do not entirely meet our need.⁷

Our survey has shown that an increasing number of psychologists are becoming aware of the importance of context. The time is therefore ripe to seek more assiduously those laws that define the influence of ground upon figure, context upon judgment, traits upon behavior, frames of reference upon attitudes and activity, situational fields upon

⁷ It does no good to object that everything in the universe supplies a context for everything else, that "if a man is ever to utter the whole truth about a natural event, he must not shut his mouth until he has expressed all nature" (7, p. 445). It is still a question of *what degree* of limitation upon the system chosen for study is most serviceable. Because some limitation is obviously required it does not follow that the most fruitful level to adopt is that of the most isolated possible motor automatism (the elementary discrimination).

performance. These contextual laws are stepping stones toward that form of synthetic understanding on the basis of which truly serviceable predictions concerning individual happenings are made.

One large section of our profession will claim success in the line of approach I have indicated. Clinical psychologists will say that their daily work requires all manner of individual predictions, and that guidance is based upon it. In principle they are right, but two admonitions are in order. First, clinicians need to check their judgments rigorously, for the validity of clinical predictions is rarely known. Further, they need to make explicit the basis on which their correct predictions are made. Urgently we need to know the way in which successful predictions in individual cases are arrived at. In the meantime psychologists in general might do worse than study the bases of correct predictions made by statesmen, psychiatrists, lawyers, and even head waiters, whose skill in forecasting important aspects of human behavior is greater than ours. If we can first learn from them, we may ultimately teach them and ourselves more. To raise our level of prediction above that achieved by common sense, even by superior common sense, should be our steadfast aim.

UNDERSTANDING

To the power of prediction science adds the capacity to understand what we observe. By understanding I mean the ability that human beings have to place details of information within a pattern of thought. Psychologists have long known that no fact apprehended ever stands alone, for it cannot be a fact until it is embedded within, and interpreted by, a context to which it is in some way related. With the advent of dynamic psychology it became common knowledge that what is accepted as fact depends very largely upon the individual's sense of the importance of fact, each individual carrying with him convictions concerning what is important for him.⁸ Sometimes we call these convictions his values. Unless we can first comprehend our subject's value-context, we are unable to know the significance of his behavior as he performs it, for the simple reason that the behavior we perceive is instantly ordered to *our* own presuppositions without any regard to what *his* presuppositions may be. In other words, our frame, not his, supplies the context.

Let me give an illustration. Suppose a psychologist sets about to study learning. Suppose, too, he brings to his task a firm sense

⁸ Especially instructive is A. N. Whitehead's discussion of the relation between matter-of-fact and the sense of importance of fact (35, Chap. 1).

of the importance of mechanical connectedness. He observes the subject's behavior, and since fact depends upon the sense of the importance of fact, he interprets this observed behavior in terms of his own presuppositions concerning mechanical connectedness. Now, the learning itself was achieved by an individual who had a very different sense of values. He was not learning in order to demonstrate mechanical connectedness to himself, but in order to acquire something important to him. Shall the psychologist understand this behavior with the aid of his own imperatives or strive to understand it in the light of the subject's imperatives? In the former case mechanical connectedness becomes the chief law of learning; in the latter case interest and importance become the chief law.⁹

Instead of attempting to understand the other organism's point of view and interpreting his activity in reference to this, it is our custom early in our investigations to disregard or even to disrupt his context of behavior, and, instead of comprehending his activity within his frame of importance, to interpret his behavior in terms of our own. Moreover, when we make rational reconstructions of our findings (constructs), we do so from the point of view of our presuppositions and communicate them to other scientists sharing these same presuppositions. In the course of this procedure the pattern of trends peculiar to the organism, what the organism is trying by himself to do, is almost completely lost to sight.

You will recognize that I have here been skirting the problem of *Verstehen* formulated and explored by German psychology; and you will admit that it is one of the leads from German psychology that has not been followed very far by Americans. Our own psychology would profit if we undertook to apply to it our genius for clarification. There are, of course, in America a few theoretical skirmishes with the problem (2, 17), and some native experiments that point the way, among them the investigations of Murray and his collaborators (25), L. B. Murphy (24), Allport, Walker, and

⁹ To be sure, the organism has a way of insistently making its point of view apparent, trying, as it were, to tell the psychologist that the primary law of learning lies in this sense of importance. So the psychologist then postulates demands or drives to account for learning, but continues to view these within his (the psychologist's) own frame of importance. Our current conceptions of motivation are not framed from the subject's point of view. If they were, we should study less often mechanical retroaction, and more often the classificatory power that interest confers on memory; less often the effects of specific incentives or drives, and more often the mature interest systems in accordance with which human beings acquire their knowledge and skill.

Lathers (1), Estes (14), Cartwright and French (11).¹⁰ In various ways all these experiments have shed light upon the process of understanding the contexts and imperatives that determine behavior from the subject's point of view.

Let us turn back for a moment from the subject's sense of importance to the experimenter's. To some extent it is inevitable that in striving for system each of us plan his experiment in his own way, select his instruments and subjects, and draw his interpretations in accordance with his own presuppositions, excluding what is not consistent with his frame of importance. Such natural pedantry is not necessarily an evil, for specialization must be allowed within our extensive subject matter. But it follows that, unless we have a diversity of presuppositions and interests in our science, we shall lose all those forms of experience that are automatically excluded when but one set of presuppositions is followed. Especially today variety is needed, for limited and miniature systems are in fashion, from which exclusions are exceedingly strict.

Our survey has shown that this is an age of interest in methodology. What it has not so clearly shown is that the purveyor of methods is necessarily asking you to accept his own frame of presuppositions. It is for this reason that it becomes necessary to scrutinize the consequences of any commitment of method. Even so harmless a methodological doctrine as operationism is fraught with unexpected entanglements.

In an age of turmoil, one hundred and seventy years ago, Voltaire made the demand: "If you would converse with me, you must first define your terms." In our present age of turmoil, operationism is making the same refreshing demand (31). It is a demand that appeals to all sensible men. Now, the best way to define a term is by the use of the typical instance or event. When we speak operationally we say, in effect, "I mean something which is illustrated by the

¹⁰ The importance of this last-named experiment, soon to be published, lies in its demonstration that in judgments of personality the validity attained by each of two judges can be in excess of their reliability. That is, two investigators may have demonstrable correctness that exceeds their agreement with one another, because each understands different aspects of the subject's personality. It follows that when we pare down our acceptable data until only that portion remains upon which all investigators agree, we are left with less than our just scientific reward. What is needed is a method of combining demonstrably valid insights rather than a reduction of our data to the bare bones upon which all observers may objectively agree.

following actions." In this way, through the telling illustration, we communicate a prior understanding in ourselves in order to arouse a like understanding in others. Operationism thus may become a useful tool of understanding.

But when the operationist goes further and insists that "a concept is synonymous with the corresponding set of operations," can he mean what he says? If so, there must be an infinitude of discrete concepts. Think, for instance, of all the different operations that have gone into the study of learning. To prevent complete and senseless pluralism operations have to be grouped by classes, and there is ultimately no way of grouping them except by relational thought. The most austere operationist communicates not operations, but a prior concept, for operational symbolizing depends upon prior ideas of entities and relations that are symbolized. Even if we try to rely upon the "standard experiment," as Tolman proposes, to serve as the operation by which a concept is defined (32), it is only by virtue of some act of understanding that the equivalence of this experiment with others can be established.¹¹

It is not to operationism's demand for illustrative definitions that objection can be made, but to the fact that its hidden metaphysical presuppositions of extreme nominalism beckon us away from the fundamental problem of how we know things together. Hyper-aesthesia for our operations and anaesthesia for understanding make us lose our way in an infinitude of detail. Synoptic views become more and more difficult; an entropy of scientific energy sets in. Fearful lest we imply that we did something more than our experiments indicate, we are tempted to give up our search for useful generalizations and to disclaim responsibility for the wider application of our work.

Along this path lies skepticism which—as historians have noted—sends forth its pallid bloom at the end of eras of great intellectual

¹¹ Critics have pointed out that the agreements under the operational creed do not go deep, and that the unity of science is after all not just around the corner. Some advocates of operationism maintain that it readily includes both immediate experience and the introspective technique within its view, some think the opposite; some would admit purposive interpretations within operationism, others would exclude them; some think that field theory fits, some that it does not. And if, as some say, its sole objective is to separate the rational criteria of inquiry from the positive and experimental criteria, then there is but temporary gain, since we have to return to understanding in order to know-together the rational and empirical ingredients of the analysis.

advance. Permit me to quote two passages from a recent methodological book written by an able experimentalist:

Science after all is only one of the games played by the children of this world, and it may very well be that those who prefer other games are in their generation wiser. It must be remembered, however, that *science is a game* and those who play it have a right to insist that it be played according to rule. If some of the players, or the bystanders, try to change the rules, the game will go to pieces, or at least, it will not be the same game (26, p. 57).

And again:

Science is a vast and impressive tautology. Its laws are summaries of observations, its hypotheses involve arguments that are circular. Since its explanations are true only if they can be demonstrated empirically, they explain nothing that is not already known. The mystery which surrounds the life of man is as dark today as it was when man first came out of the jungle, and will be just as impenetrable when the last surviving scientist thinks his concluding thought or writes his final sentence (26, p. 154).

Such weariness is inevitable so long as we make the test of psychology one of fidelity to method rather than to understanding, prediction, and control. Methodism as the sole requirement of science means that all the faithful crowd onto a carpet of prayer, and with their logical shears cut more and more inches off the rug, permitting fewer and fewer aspirants to enjoy status. Two debilitating attitudes result: that of the playboy who likes his childish games, and that of the fatalist who sees no duty devolving upon a scientist other than that of formal ritual. The survival value of either attitude is zero, for both lead us, and all those who look to psychology for help, to believe that psychology has no essential relation to life, and that human events lie entirely beyond our control. Such a belief undermines the very civilization that has endowed psychology with its freedom, in return charging it with the contribution of useful knowledge.¹²

CONTROL

Until our deficiencies in prediction and understanding are repaired, it is unlikely that psychology can go far in meeting the third and

¹² Not infrequently the skeptic derides applied psychology. Outside the laboratory he lives a cultured and varied life of a free agent and useful citizen. Yet his methodical work in the laboratory overspreads very little of his daily experience and prevents integration in his life. Though he generally repudiates a dualism of mind and body, he welcomes the equally stultifying dualism of laboratory and life.

supreme criterion of validity for science—that of practical control of human affairs. The clinician is most active in this direction. He and other consultants, educators, and technicians are controlling human events, but whether more successfully than unaided common sense could do depends on evidence still to be supplied in conscientious records of success and failure.

Outside of the clinical field little control is attempted. The man of common sense approaching our treatises for help finds that a large portion of his daily conduct is not only left unexplained, but is not represented at all. From agencies of government, industry, education, and human welfare come daily appeals for assistance in their service to mankind. Psychology, as science—may I repeat?—can be justified only by giving mankind practical control over its destinies, not by squatting happily on a carpet of prayer.¹³

FRAME OF REFERENCE

Fortunately, currents engender countercurrents. The flow in psychology today is not altogether toward the shoals and reefs of formalism and of skepticism. Our evidence (Fig. 12) shows a strong revival of interest in the problems of context, which of necessity include the structure of the human personality and its activity within its social surroundings. To study highly integrated functions at levels where serviceable prediction and understanding result is, of course, a most difficult undertaking, requiring inventions of method not dreamed of today; requiring, also, the borrowing of many tools of precision and safeguards of measurement from the experimentalist's storehouse. It is characteristic of this new movement that its concepts have a realistic and humanistic flavor, for it is vital in this new work to believe that something real and substantial is under investigation.

An example of the trend is the growing interest in the *frame of reference*, a concept which I have appropriated for the title of this address. It is of recent origin and may for that reason be viewed with suspicion. Yet it is, I feel sure, the legitimate offspring of the flourishing principle of dynamic differentiation. It expresses the

¹³ It seems only fair to add that there are signs of a growing demand among psychologists for significant and useful research. The demand is clearly apparent among social psychologists, and elsewhere as well. T. L. Kelley, speaking recently to mathematical psychologists, has urged them to invent and employ "measures of utility" in order that the factors they conjure into being may turn out not to be factors of just no importance at all (16).

importance of context; it repairs the ravages that result from viewing the behavior of other organisms exclusively within the investigator's frame of presuppositions; it aids in understanding. Its fruitfulness is seen in many experimental studies of the past five years, including those of Ansbacher (4), Cantril (10), Darley (12), Kornhauser (18), McGregor (22), Sells (28), Sherif (29), Stagner (30), Watson and Hartmann (34), and others.

Frame of reference has to do with any context whatever that exerts a demonstrable influence upon the individual's perceptions, judgments, feelings, or actions. Often the influence is—to use Köhler's term—"silent." Of the existence of frames the subject himself is only partially aware, and unless he is well warned the investigator too may overlook them entirely. At the present time it is especially the social and dynamic psychologists who are ardent on the trail, although much pertinent related work is found wherever there is research upon problems of equivalence, aspiration level, life space, constancy phenomena, and psychophysical judgment.

Many frames, of course, especially those encountered in psychophysics, are neutral and impersonal in type, providing simple spatial and temporal orientations. Others are personal and ego-involving.¹⁴ The position of college buildings upon a campus is an impersonal spatial system that orients and directs our excursions to and from our classes; but our status within the collegiate hierarchy is of a more personal order, charged with intimate importance to ourselves, and determining affective attitudes of motivational significance. Dynamic and social psychologists are especially concerned with these personal, ego-involving frames, and are often able to show that what are sometimes thought to be neutral-perceptual judgments, even the judgments of scientists themselves, are not wholly determined by an objectively established frame, but are entangled deep in the web of personality.

The relation of frames to *attitudes* and to *traits* is a problem yet to be worked out. These concepts all refer in various gradations to complex and relatively persistent forms of mental organization. Their popularity, together with that of *trend*, *need*, *sentiment*, and other kindred concepts, gives support to McDougall's claim, expressed in one of his last papers, that the most indispensable doctrine in modern psychology is that of *tendency* (21). All are frankly class

¹⁴ In making the distinction between personal and impersonal frames, T. A. Ryan (27) confines the former to certain self-referred systems of space, time, or meaning, neglecting to consider the emotional frames that are ego-involving.

concepts, and can be defended, I think, for the superior promise they hold in our triple task of predicting, understanding, and controlling behavior.

Class concepts though they are, they do not necessarily exclude considerations of cultural influence nor the situational field. It is especially those frames of reference adopted as the "wise prejudices" of our own station, class, and culture that reflect prevailing social norms. We are now making progress in the detailed study of conforming behavior, in the composition of ideological thought, and in the genesis and development of frames in childhood.¹⁵ We are beginning to sort out that monstrously tangled heap our Councils have christened "personality and culture." Not yet, however, are we able to tell what makes a mauve decade mauve, or a skeptical age skeptical, or psychology in the 1880's soulful and in the 1930's soulless. Nor do we know the extent to which a man can shake himself free of the influence of his times, or even recreate them to his liking. Freud, we know, had something to do with Queen Victoria's downfall; but was he consequence or cause? Who can say?

Speaking on this very campus forty years ago, John Dewey, later to become the eighth president of our Association, made what for that time was a striking observation (13). Psychology, he held, cannot help but be politically conditioned. He had in mind, for example, the fact that doctrines of the fixedness of human nature flourish in an aristocracy and perish in a democracy. The privileges of the elite in ancient Greece, and the doctrines of the Church in mediaeval times, provided the setting for psychological theories of their day. Under modern conditions theories of statehood play a major role.¹⁶

The president of the *Deutsche Gesellschaft*, addressing that organization last year, praised typological studies that enabled psychology, in matters of heredity, race, and education, to pick out the national *Gegentypus* whose unwelcome qualities are individualism and intellectualism. In passing, he warned against using the mental tests that one of the great figures in psychology, William Stern, a

¹⁵ Especially fascinating are the problems in this area. Consider, for example, the question which frames the child adopts from his playmates and which from his parents. Matters of politics and religion he ordinarily seems to refer to frames taken from parents, but standards of speech and clothing to frames acquired from his contemporaries. Why does he do so?

¹⁶ In this connection the striking fusion of John Dewey's own psychological theories with his allegiance to democracy is well worth special study (cf. 3, Chap. 9).

Jew, had introduced, and said that he wondered not at all that some of his colleagues had been censured for pursuing a pre-revolutionary course of thought. At the same time he added:

Antagonistic foreign countries speak of coordination (*Gleichschaltung*) whenever conformity of science and politics is perceived. No, this conformity is certainly not based on coordination, but upon the fact that politics and science, now for the first time, strive after truth even in the basic questions of existence, over which heretofore darkness and error reigned (15, p. 14).

And what is the situation with us? Do we American psychologists lack politically determined attitudes? At first thought it would seem so, for are we not entirely free in our individual researches, and may we not hold any fantastic view that we choose? We may, and that proves the point for the political determinist, for only in a democracy can anything like a "socially detached intelligentsia" be realized. On the theory that democracy will ultimately gain by giving each thinker all the space he wants, we American psychologists are subsidized, encouraged, and defended. Each worker may elect, as he pleases, any section or subsection of psychology that he finds suited to his taste and abilities.

The desirability of keeping alive diversified investigation and a diversified sense of importance is the generous lesson that democracy teaches us. Now, if ever, must we learn it well and apply it to ourselves. If we rejoice, for example, that present-day psychology is—as Bills has pointed out (5) and as our survey has shown—increasingly *empirical, mechanistic, quantitative, nomothetic, analytic, and operational*, we should also beware of demanding slavish subservience to these presuppositions. Why not allow psychology as a science—for science is a broad and beneficent term—to be also *rational, teleological, qualitative, idiographic, synoptic, and even non-operational?* I mention these antitheses of virtue with deliberation, for the simple reason that great insights of psychology in the past—for example, those of Aristotle, Locke, Fechner, James, Freud—have stemmed from one or more of these unfashionable presuppositions.

My plea, therefore, is that we avoid authoritarianism, that we keep psychology from becoming a cult from which original and daring inquiry is ruled out by the application of one-sided tests of method; that we come to evaluate our science rather by its success in enhancing—above the levels achieved by common sense—our powers of *predicting, understanding, and controlling human action.* As an aid to progress I have tried especially to strengthen the case for research

upon complex patterns of human mental organization, frames of reference, the subject's point of view, and the act of understanding.

If we but watch with amused humility our own personal frames affect our perceptions and our deeds, we will then enjoy and profit from our disagreements. Best of all, we shall be able to sink these disagreements into a common determination that the vast horizons of our science shall not prematurely close down, neither through bigotry, nor surrender to authoritarianism, nor through our failure to pay our way in the civilization that is sustaining us.

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THE PRODUCTION OF 16-MM. MOTION PICTURE FILMS¹

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INTRODUCTION

The motion picture is one type of modern scientific publication that is becoming increasingly popular in many fields of investigation. The usefulness and value of the motion picture as a research record, a teaching instrument, and for general dissemination of information to large groups of people at one time have been well established. Many workers in scientific and educational fields have in recent years set themselves to the task of recording on film various experiments of different kinds that have been conducted in their laboratories or in those of other researchers. However, anyone who has looked at a number of scientific motion pictures has been impressed with the fact that there are good ones and poor ones and has himself seen some of the faults that need to be remedied. It seems only reasonable to expect that the instructor, in employing motion pictures in his classroom, should, so far as possible, be relieved of the necessity of making apologies for the poor workmanship exhibited in the film. Respect for science can be increased or sacrificed through the medium of instructional films. In fact, they give an impression that is difficult to eradicate. Therefore, the construction of these materials should be most carefully planned. It is hoped that the suggestions that follow may call attention to some of the more common errors in film production and perhaps in some measure aid in raising the standards of scientific motion pictures.

The literature on careful motion picture production is remarkably scarce when one considers the number of cameras in use in the nation today. There has been a definite need for a simplified manual that can be made accessible to the laboratory research worker and to prospective producers of educational films. It is hoped that this guide will in some measure fill this need. The attempt has been made to

¹ A report prepared under the auspices of the Committee on the Use of Motion Pictures and Sound Recording Devices of the American Psychological Association.

approach the problem of film production from as practical a stand-point as is possible. In bringing this material together, the writers have been in constant touch with technical experts in the field who are in full-time production of motion pictures for educational and commercial purposes. With this approach it was hoped to arrive at a manual that will be not only simplified, but technically correct, and which will include a number of the "tricks of the trade" that may mean the difference between an ordinary picture and a good film.

We are glad to acknowledge our debt to Mr. George Volger, Department of Cinematography at the University of Southern California, for assistance in the early stages of the formation of the manuscript; to Mr. Paul R. Wendt, Production Manager, Mr. Theodore Mills, Motion Picture Editor, Visual Education Service, University of Minnesota, and Mr. L. C. Larsen, Visual Education Research, University of Minnesota, for critical reading of the manuscript and technical advice. Dr. Edgar Dale, of the Bureau of Educational Research, Ohio State University, and Mr. Francis W. Davis, of the Department of Photography, Ohio State University, also read and criticized the manuscript. In addition to the technical information supplied by these men, 2 psychologists with long experience in 16-mm. production, Dr. Edgar Doll, Director of Research, Training School, Vineland, New Jersey, and Dr. William A. Hunt, Wheaton College, have also contributed heavily to the present form of this paper.

THE CAMERA

The first, and perhaps the most important, consideration in film production is the type of camera to purchase. Only the best and most versatile cameras should be used in order to obtain the clearest, most accurate, and faithful reproductions of the work we wish to make available to others or to record for our own permanent record. The initial cost of the camera is small compared to the cost of the film which will eventually be consumed in the production of several subjects. It is exasperating to find that, after using a certain camera for a while, it has definite limitations which prohibit it from being used at maximum efficiency and force one to produce a film that does not satisfy his standards of excellence.

It is advisable that the camera be one that is built for 16-mm. film, since this size has become the standard nontheatrical equipment. In the entertainment field and for commercial use where a very high

quality is demanded, the pictures are made originally on 35-mm. film and can usually be obtained for projection at that size or at the 16-mm. size to which they can be reduced. For most school and laboratory purposes the 16-mm. camera will be found to be the most practical camera to use, and from the economic standpoint, it will be the easier to accommodate to the budget. A wide variety of models is available from about \$40 to \$400.

A variable-speed camera will be found to be a decided asset for many films of psychological interest. This will make it possible to take "slow-motion" pictures which are valuable in the portrayal of rapid and complex operations in a manner that will be easy for the observer to follow. For this purpose the film is exposed at the rate of 32, 64, or even 128 frames per second. If the subject to be photographed calls for a camera speed greater than 128 frames per second, it is possible to obtain stroboscopic cameras or to substitute a revolving prism for a lens camera. These special cameras will operate up to 2000 or 3000 frames per second, or at the limits of the available film, but their great expense and the amount of film consumed in their operation preclude their extensive use in most laboratory work. The most economic arrangement for this ultra-high-speed work is to take advantage of the few cameras that are available at various centers like the Massachusetts Institute of Technology.²

Eight-millimeter cameras are not recommended at this time for 3 reasons: A previous survey³ has shown that colleges are not now equipped with 8-mm. projectors; the present 8-mm. cameras do not have the flexibility that the 16-mm. size has; there is no 8-mm. sound projector now available.

LENS EQUIPMENT

Perhaps the most widely used lens in 16-mm. work, and the one that is recommended, is the 1" F 1.9 lens (cost, approximately \$50 to \$75). For outdoor work where the lighting is very good, the F 3.5 lens has been found to be satisfactory. For fast work, and for work where lighting is a problem, a lens with an F-value of less than 2.7 should be used. These are called "fast lenses." The lower the F-value, the larger the effective area of the lens and the greater the amount of light admitted. The fast lens at wide stops focuses

² Communicate with Dr. Harold Edgerton, Massachusetts Institute of Technology, Cambridge, Massachusetts.

³ Valentine, W. L. Report of a survey conducted by the Motion Picture Committee. *Psychol. Bull.*, 1938, 35, 423-429.

very critically. As a result, fast lenses are sold in micrometer focusing mounts. The necessity for careful focusing increases even more with a fast lens than with an ordinary lens as the object approaches the camera. It is consequently quite essential to be sure of the exact distance from the object to the camera when using one of these fast lenses. If the camera is equipped with a reflex finder and focusing device, this problem will be greatly simplified. Although the reflex finder and focus is considered by many to be absolutely indispensable for accurate work, neither is usually furnished as part of the standard equipment of 16-mm. cameras.

Wide-Angle Lenses. In photographing at close quarters where the laboratory room does not allow space enough to permit the inclusion of everything wanted in the field, the wide-angle lens proves its worth. With the 15-mm. F 2.5 lens (cost, approximately \$35 to \$50), the photographer can gain the widest angle of vision which can be obtained with a 16-mm. motion picture camera. Its field is 40% wider and 40% higher than that of the standard 1" lens. Unfortunately, most 16-mm. finders do not delineate the field of the 15-mm. lens. Without a finder that does indicate the field limits, so much is left to estimation that the photographer had better do without the more extensive field.* Finders providing the wider field may be had as special equipment at additional cost.

Long-Focus Lenses. For magnification where it is impossible to get close to the subject, as in photographing animals and children, and on certain special problems, the telephoto lens is often valuable. For most laboratory purposes, the 4" F 4.5 lens (cost, \$70 to \$80) will be found to be the most useful where magnification is desired. It focuses from 3' to infinity and has a remarkable depth of field. The best results in telephoto work, as in all motion picture work, are obtained only if great care has been exercised to make sure that the correct exposure has been determined. In this regard it should be noted that only the area actually included within the picture should be checked with the exposure meter.

Additional magnification may be secured by using extension tubes between the camera and lenses. These tubes may be purchased commercially to fit some lenses, but usually they will be prepared in the departmental shop. When extension tubes are used the camera is

* One exception to this generalization might be noted: In some research problems the camera is *always* the same distance from the subject. In these cases the extent of the field can be determined by careful measurement, and since it is constant, no further attention need be given it.

placed only a few inches from the subject. In such cases the index indicating the distance at which the lens is focused is useless, so that direct visual focusing by means of a reflex focusing device must be employed. This technic is useful in photographing small animal subjects, like the insects, or in indicating the operation of some delicate laboratory apparatus or some small part of a larger setup. When extension tubes are used the depth of focus is *extremely* shallow,⁵ so that it is well to acquire some experience generally before attempting this specialization.

The Care of Lenses. The image-producing qualities of even the best lens can be seriously modified by a deposit of dust or a finger-print on the lens. Lenses should be kept scrupulously clean by frequent cleaning with a lintless lens paper available through photographic supply houses. Rough cloth scratches the lens surface; linty cloth does not accomplish the purpose.

FILM

The type of film to be used depends upon the quality of the work desired, the availability of illumination for the objects to be photographed, and the speed of movement to be recorded. There are 4 types of film commonly used. These are orthochromatic, panchromatic, fast panchromatic (supersensitive panchromatic; super pan), and ultra-fast panchromatic (ultra-speed panchromatic; super xx). The orthochromatic film is the cheapest of the 4 in first cost, but requires a much greater amount and a more carefully controlled light than the other 3. The fast panchromatic is perhaps the most universally used, inasmuch as it is quite a sensitive film and will handle a good many shots under varying light conditions. The ultra-fast panchromatic requires the least light of all, and is recommended for shots in which the lighting problem is difficult or in which unusual clearness is essential. If adequate lighting is available, and if the power cost does not have to be considered, orthochromatic film can be used at a considerable saving.

All of these films are reversible; that is, when they are returned from the laboratory they are positives ready for projection.⁶ By using a negative film, which can also be obtained through the usual

⁵ Because the camera lens has been converted into a low-power microscope by means of the extension tube.

⁶ The price of 16-mm. film, as sold by either wholesaler or dealer, includes processing (development of negative and reversal into positive image) at the laboratory.

commercial channels, a negative and a positive print of it are returned. There has been considerable discussion of the relative merits of these 2 methods among photographers. If a large number of prints are to be made, the negative method is more economical, but the photographic effectiveness of the product is reduced by the "grainy" effect produced by negative film.

With the development of the modern color films many new possibilities are opened to the photographer. Since color film is specially prepared with 2 emulsions for either indoor work or outside work, the photographer should take care to specify the type of work to be filmed when purchasing the film in order to avoid unsatisfactory results. The faithfulness with which colors are reproduced depends, most of all, on the skill of the cameraman in lighting his subject and in selecting the proper lens stops, but, even under the best conditions, one could not say that the colors finally projected are accurate reproductions of the original. The apparent accuracy of rendition is largely a matter of "perceptual filling." Even so, color has proved to be of value in medical, biological, and geological fields. But in these instances, the color of the subject or changes in its color are an integral part of the film story. Most psychological subject matter is as effectively presented in black and white. Until recently there was no satisfactory method of duplicating color films, but now the Eastman Company duplicates Kodachrome at 10 cents a foot.

CAMERA OPERATION

The first step in mastering the technic of camera operation is to learn thoroughly the technic of threading the film properly in the camera mechanism. This operation can best be learned from the instruction book which comes with each new camera. Suffice it to say here that special attention should be given to 3 things: first, that the teeth of the sprocket wheels engage the film perforations correctly when the rollers are in place; second, that the film is properly seated in the gate; third, that the film is securely attached to the hub of the take-up spool. A few feet run at 8 frames per second before closing the camera will permit a photographer to be certain that these 3 requirements have been met. Extra footage is supplied by the manufacturer for this purpose. If the factors mentioned above are not attended to, the film will jam in the camera—an expensive mishap, because film so damaged can seldom be salvaged even if a darkroom is available.

The camera should never be loaded in direct sunlight. Although the daylight-loading spools featured by some manufacturers are effective in partially protecting the film, with the fast emulsions now supplied even a small amount of light may fog the film, so that it is better to load the camera in the shade, in a spot sheltered from the bright sky, indoors, or under a dark coat or garment. The same precautions should be followed in unloading the camera after the picture is taken. It is necessary at all times to see that the film is kept tightly wound on the spool, for if it is allowed to come loose in handling, there is a great danger that fogging will result.

EXPOSURE

In preparing to photograph the subject, the next important step is to set the lens stop for the proper exposure. If the light is bright, the diaphragm opening must be made small. If the light is dull, the opening must be increased, or underexposure will result. Serious overexposure results in a thin, pale image on the screen, while underexposure gives a dark, rather grainy screen result. Since the actual size of the diaphragm opening controls the amount of light that is allowed to reach the film, it is important to know the significance of the different sizes of these openings as indicated by means of the stop numbers. It is useful to remember that each smaller stop number, as listed below, gives approximately one-half the exposure of the preceding one. A typical set of ciné stop numbers, arranged in order from greatest to least, runs as follows: F/2—2.8—4—5.6—8—11—16. It should be noted that the intermediate steps, such as 3.4 between 2.8 and 4 and 6.8 between 5.6 and 8, vary on a scale of approximately halfway between those listed. The important thing to keep in mind is the fact that as the stop numbers grow larger the stop opening becomes smaller, so that the larger numbers allow less light to enter. The standard F 3.5 lens can be set at smaller diaphragm openings, that is, from F 3.5 to F 16, but cannot be set at larger openings. The control of the diaphragm, whether the lens in use is fast or slow, is the foundation of all exposure problems. It is based upon both the light-reflecting qualities of the subject and its illumination.

Although elaborate exposure charts are prepared by practically every camera manufacturer, listing diaphragm stop openings for all conditions from that of a wooded ravine on a cloudy day to a white,

sandy beach on a bright, sunny day, they are all dependent upon the human element for the interpretation of brightness and dullness of light intensity and reflection. Photographers of long experience frequently estimate the amount of light on a scene incorrectly, due to the adaptation of the eye over a wide range. To ensure the best results under all conditions and to eliminate all guesswork in determining the correct opening to use, a reliable exposure meter is indispensable. Readings for the stop settings of the diaphragm and the exposure time can be taken directly from an exposure meter, assuring the best results obtainable under the lighting conditions prevailing and the type of film being used. A photoelectric exposure meter that integrates all of the light from the subject is preferable.

FOCUSING

To obtain clear, sharp pictures, careful attention to focusing is necessary. Only for those cameras which possess a universal focus lens—one whose adjustment in the camera cannot be altered by the photographer—is this not a problem, and, even then, with this lens care should be taken that the object does not come closer to the lens than approximately 5'. When the image of any given subject appears on the film, defined in the sharpest and clearest manner possible, the lens is said to be critically focused on the subject. To accomplish this critical focusing, the lens barrel is turned until its index is set at a footage mark which corresponds to the distance of the object from the camera. It is suggested that a steel tape measure be obtained in order to make for greater accuracy and lead to more successful pictures.

Theoretically, if the object moves toward or away from the camera while the lens is still set at the proper footage mark, it will be out of focus on the film in proportion as it deserts the original location. However, in practice, it is found that a satisfactorily sharp picture is possible even though the object may change its position by moving toward or away from the camera. This distance through which an object may move toward or away from the camera and still remain in satisfactory focus on the film is known as the *depth of field*. This depth is governed by 2 factors: first, its limits are reduced as the object comes nearer to the lens; and second, it *increases* as the diaphragm opening *decreases*.

A table has been prepared showing the satisfactorily sharp depth of field obtainable with different lenses and different stops, which is

a useful guide in determining proper stops and proper lenses to prepare to use for shots at varying distances. It is given below:

TABLE I

Depth of Field :	Distance of Camera From Subject			
Covered by :	20'	15'	10'	5'
1" F 1.5 lens				
at F 1.5	15'-50'	10'-30'	8'-15'	4'6"-6'
at F 3.5	8'-Inf.	7'-50'	5'6"-30'	3'6"-8'
2" F 3.5 lens				
at F 3.5	14'-35'	11'-21'	8'-12'	4'6"-5'6"
4" F 4 lens				
at F 4	17'10"-23'	17'10"-16'6"	9'5"-10'8"	4'10"-5'2"

SIZE OF FIELD

It is also wise to be sure of the size of the field, that is, the width and height that is being included in your picture as you are filming it. If care is not taken there is quite a possibility of failing to include important items in the film, or again, there is the possibility of including in the picture irrelevant material or objects that definitely distract from the value of the picture. Here again, it should be mentioned that the reflex finder and focusing device is the only really satisfactory means of determining the area included on the film.

However, for those who already have equipment and are unable to obtain a camera equipped with the reflex finder, the following table may be of service:

TABLE II

Size of Field :	Distance of Camera From Subject			
Covered by :	20'	15'	10'	5'
1" lens	5'9"x7'10"	4'4"x5'10"	2'10"x3'10"	1'5"x2'10"
2" lens	2'10"x3'10"	2'3"x2'10"	1'6"x1'11"	9"x11"
4" lens	3'2"x4'4"	2'5"x3'3½"	1'3"x1'9"	9"x12½"

INTERIOR LIGHTING

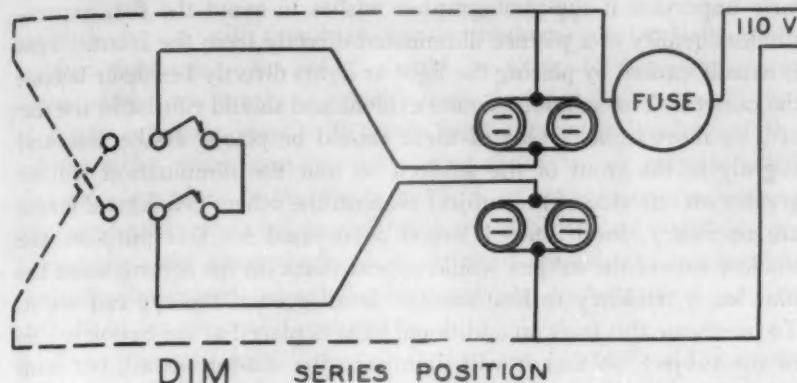
Since the majority of pictures to be made that are of interest to the psychologist are made indoors, the question of artificial lighting is of importance. Fortunately, with the advent of the supersensitive film as well as the introduction of the Photoflood bulbs, the problem of securing a light source that is powerful and effective for indoor conditions is far less complicated than it has been in the past. The Photoflood bulbs now in most general use (No. 1, 20 cents each) are no larger in size than the ordinary 60- or 100-watt lamps, yet 2 Photoflood lamps will deliver an amount of light practically equal-

ling that given by the 500-watt, concentrated filament projection type. Where lighting is difficult and a greater concentration of light intensity is needed, the Photoflood bulbs are obtainable in the intermediate (No. 2, 40 cents each) and the giant (No. 4, \$1.60 each) sizes. The life of a Photoflood lamp is from about 6 to 10 hours. Although this may at first seem to be a very short life for a lamp, it may be remembered that few scenes last longer than from 30 seconds to 2 minutes and that only during this time does the bulb itself need actually to be burned. Lighting arrangements, planned beforehand, may be tested with ordinary bulbs at lower wattage in order to conserve the life of the Photoflood bulb and allow it to be burned only during the time the picture is actually being filmed, or for the few seconds necessary to check the actual amount of light with an exposure meter in order to be sure of the correct stop settings on the camera.

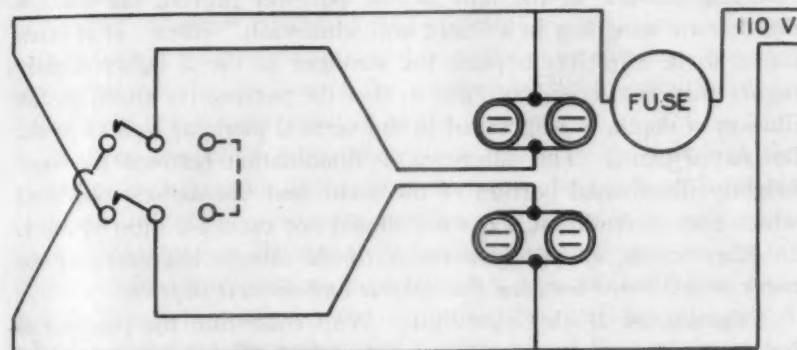
However, a simple arrangement that can be easily made up in the laboratory and that will pay for itself many times over in time and money saved is a double-switch setup for lighting the Photofloods in series for aiming and directing lights and in parallel for the actual shooting. It has been found that a portable unit box switch with the 2 switches and circuits wired in a small compact unit is ideal. When the lights are wired in series, the voltage delivered to them is materially reduced, and since the Photoflood lamps really operate on the principle of overloading the filament, it will be readily seen that a great saving on lights can be achieved, for the Photofloods will burn almost indefinitely with a load beneath their rated voltage. This also allows for more time to arrange the lights and saves the nuisance of having to change bulbs for the directing and aiming of the light sources. After the lights have been satisfactorily arranged, a simple flip of the switch will give full illumination for the actual filming.

Where spot lighting is desired, a cheap and effective solution is to be found through the application of the basic principle of the Photoflood lamp (overloading the capacity of the filament) to a nonfrosted incandescent lamp. This can be accomplished with the use of an 80- or 90-volt bulb on the regular 110- to 120-volt circuit. This overloading will give intense brilliance, and the clear lamp bulb will allow for an accurately directional light when used with an efficient reflector. The low-voltage lamps are not available on the open market, but may be obtained by writing to the manufacturer.

A new lamp with the same characteristics as the No. 2 Photoflood has just made its appearance. It incorporates a reflector applied to



DIM SERIES POSITION



BRIGHT PARALLEL POSITION

(Courtesy of Paul Wendt, Production Manager of Visual Education, University of Minnesota.)

the internal surface of the bulb in the manner of lamps used for spot lighting shop windows.

In preparing the subject to be filmed, the nature of the background and general surroundings should be carefully considered. For, after all, it is not how much light is directed onto an object or an area, but how much light is reflected into the lens of the camera that is important. With this in mind in checking for exposure ratings with an exposure meter, it is essential that care be taken to measure the amount of light reflected from the main object of interest in the picture and to shield the meter from the primary sources of light.

Location of Lamps. Location and placement of lamps is particu-

larly important if the photographer wishes to avoid the flat, expressionless quality of a picture illuminated directly from the front. This is usually caused by placing the light or lights directly beside or behind the camera. The solution is quite evident and should consist in the use of 2 or more lights. One of these should be placed at the side and slightly to the front of the subject, so that the illumination will be greater on one side of the subject than on the other. At least 2 lamps are necessary, for if only 1 source were used for this purpose, the shadow side of the subject would appear black on the screen, since the film has a tendency to lose shadow detail even if the eye can see it. To overcome this fault an additional light is placed at the opposite side of the subject, so that it will illuminate the shadow detail, but with this difference: the secondary lamp should be farther away from the subject than the primary one. This will produce the effect of a modeling shadow in the film picture but will prevent the shadow detail from being lost in a "soot and whitewash" effect. It is often found to be effective to place the stronger of the 2 lights slightly higher than the secondary light so that the perspective effect, or the illusion of depth, is heightened in the vertical plane as well as in the horizontal plane. The difference in illumination between the most brightly illuminated portion of the scene and the darkest object of which correct rendition is desired should not exceed a ratio of 32:1. In other words, *an exposure meter would show a difference of not more than 5 stops between the lightest and darkest objects.*

Illumination With Color Film. With color film the problem of lighting calls for even greater care to avoid distortions and unreal coloring. In using the indoor emulsion, all natural light must be excluded or the finished film will have purple tints. Blue lamps, or so-called "Daylight" lamps, and all forms of arc lamps must be avoided for indoor illumination when using color film, since these sources produce light which results in screen images that have a definite bluish tint. Photoflood bulbs may be used, and if the indoor emulsion is used, lens filters are unnecessary. A new 500-watt lamp known as GE 3200°K (70 cents) is recommended, however.⁷

Another factor to be considered in the lighting of objects to be filmed with color film, whether it be indoors or outdoors, is the direction of the light source. Direct overhead lighting should always be

⁷ This lamp burns at a color temperature of 3200° Kelvin, the level at which the emulsion was standardized, and can be had in other sizes besides the 500-watt medium screw base described here. The 1000- and 1500-watt sizes which require mogul screw sockets will be found useful.

avoided, for it will result in harsh shadows—particularly when making close-ups. An effort should be made to *have the scene illuminated as uniformly as possible from the front* so that the illusion of depth and roundness will result from the natural colors of the subject rather than from the position of shadows. It may be noted that *this procedure is the direct opposite of the practice in making black-and-white films where contrasts are obtained and controlled by having the light sources placed in different positions, sometimes to the side, above, and behind the objects being photographed, as well as in front for general illumination.*

Prevention of Direct Reflection in the Lens. Care should be taken to have an efficient reflecting surface around the bulb. This will not only increase the effective, directional light, but it will also provide a shield so that there is less danger of a flare in the lens. Although collapsible, silvered cardboard and asbestos composition reflectors may be bought for this purpose, and do prove quite effective, the more permanent metal reflectors of the commercial lighting units will be found to be much more effective in the long run.

If there are times when there is a doubt in the mind of the photographer as to the danger that flare may be resulting from his placement of lights in various positions, and especially with some types of side lighting, definite steps can be taken to correct this. One of the simplest, and perhaps most effective, ways of controlling flare is to be found through the use of the lens hood. This is simply a tube, blackened on the inside, and placed around the lens barrel so that it extends well in advance of the front element of the lens itself. Regular lens hoods may be purchased for this purpose, or if it seems advisable, it is quite possible to improvise a hood from an ordinary cardboard mailing tube about 2" in diameter, projecting it in front of the lens about 4". One might also be built by forming a cone from a piece of heavy black paper. The important thing to watch is that the tube or cone be not so long that the corners of the lens field are cut off. In the production of clear-cut photographs the lens hood is one of the most useful accessories.

Heat Filters. Where certain types of animal experimentation are being filmed, the heat from the light source often becomes a problem. To overcome this difficulty, sheets of blue celluloid may be fitted across the open end of the light reflectors. This will greatly reduce the amount of heat transmitted from the light to the subject and will not affect the color where black-and-white film is being used. When working with color film the blue shields should not be used, as they will give

an unreal appearance to the colors. "Water filters" may be obtained for lighting units where color film is being used or where strong spotlights are being used. These filters are simply double pieces of glass separated by a water reservoir for cooling purposes. Color is not affected with this type of heat filter.

Reflectors. Since any dark portions of the subject will appear darker on the film than they do to the eye, it is often advisable to use reflectors in addition to the luminous light sources. This may be handled by a flat plane, white or polished surface of fairly large dimensions, placed in such a position as to catch and turn back upon the subject the stray light that otherwise might be wasted and put it to use in eradicating unwanted shadows. A reflector of this nature may consist of a large piece of wallboard painted white, a white window shade which may be rolled up when not in use, a sheet hung over a chair, or even a sheet of newspaper. A reflector board will be found to be the superior and more serviceable means for accomplishing this purpose. Here again, a word of caution is in order. The reflector is, in reality, an additional source of light, and as such should be placed in such a way that it will not reflect any light directly or indirectly into the lens of the camera, or a "flare" may result.

Number of Lamps Needed. If an exposure meter is not available, the following table may be of service to some in providing an approximate means for estimating the proper stop opening to use with various Photoflood light sources at varying distances.

TABLE III

Diaphragm "Opening	Number of Lamps and Distance From Lamp to Subject for 16-mm. Super-pan Film (No. 2 Photoflood)			
f/1.9	1 at 10'	2 at 14'		
f/2.8	1 at 7'	2 at 10'	3 at 12'	4 at 14'
f/3.5	1 at 5½'	2 at 8'	3 at 10'	4 at 12'
f/5.6	1 at 3½'	2 at 5'	3 at 6½'	4 at 8'
f/8	2 at 3½'	3 at 4½'	4 at 5'	

CAMERA SUPPORT

Before leaving the subject of actual camera operation and the various details that go with it, mention should be made of the use of the tripod in the process of filming. It is annoying for the observer to be viewing a film that is continually moving, however slightly, in an unsteady manner that was never intended by the photographer. The so-called hand camera is not a hand camera at all. It must be used with some support; a rugged tripod is best. If properly set up, it will give to the finished picture on the screen a stability that will

make for easy and restful following of the course of events depicted. In purchasing a tripod it is immaterial whether it is made of metal or wood, although some of the lighter tripods are none too steady. The important factor is that it be firm and steady, without a wobble or sway of any kind when properly set up. A pan and tilt head that enables the camera to be moved in a horizontal arc or a vertical arc, as desired, is essential in making angle shots of all kinds and is very convenient for centering the subject in the view finder. Especially is the latter true when a considered inspection of the view finder and the appropriate arrangement of the camera with relation to the image wanted is necessary to get the exact effect desired. Moreover, once having set up the camera and tripod in their proper positions, one need not fear shifting the point of view inadvertently, as might be the case with a hand-held camera. In purchasing a tripod the smoothness of operation of the pan and tilt head should be carefully checked. When making a pan shot the slightest jerk or "catch" in the head will spoil the effect.

In using the tripod on a concrete floor or other smooth surface the sliding of the legs must be controlled. This can be done very simply by constructing a Y-shaped support to lie flat on the floor, with holes drilled at varying intervals to accommodate the tripod legs at various angles. This device can be quickly built from wood or, for a more permanent and more easily transported unit, it may be made from a light metal with the arms hinged at the center to fold for carrying.

A dolly, or truck, may also be obtained on which the tripod may be mounted for greater mobility. This will allow the photographer to follow a moving subject for a distance, keeping its size constant and allowing for a more careful and closer consideration of it during the period of observation and filming, as well as enjoying the advantage of a steady screen image. This camera dolly could only be used on an exceptionally smooth floor or on a special track constructed for it. Although considerable labor is involved in building tracks so that the camera can be moved, the result is often worth it, because pictures taken from a smoothly moving camera have much more apparent depth because of the factor of relative movement. Those objects nearest the lens sweep quickly across the field, while those further removed move more slowly. This feature, of course, heightens the illusion of depth.

In addition to the more common forms of camera support mentioned, the photographer may find that there are particular adapta-

tions of his own that he may make to best suit the camera support and the angle to his purposes. One means of achieving this adaptability is through the use of long or short brass rods threaded at the end to screw directly into the tripod hole on the camera. With this arrangement it is possible to mount the camera at various angles and in various positions through the use of standard heavy laboratory clamps and auxiliary rods.

RESEARCH *vs.* INSTRUCTIONAL FILMS

There is an essential difference between a demonstration film and a research film. A research film aims to present the actual results of investigation and hence is limited by all the scientific strictures surrounding the accurate and honest reporting of data. A demonstration film, however, is frankly pedagogical in nature. It presupposes the accurate observation of phenomena and their scientific reporting. Its purpose is not to repeat this process, but to teach its meaning and significance. As such, it is not limited to the same strictures for honesty as is the research film. Demonstration film may thus employ all manner of distortions, open dramatizations, frank "faking" of results, etc. It may justifiably employ all the artifices of the stage and screen. It is apparent that this point is too often overlooked, and, by holding demonstration films to the same standards of honest reporting that are necessary for research films, their scope is seriously handicapped, and they are all too often deprived of much potential pedagogical value.

In order that scientific films of the 2 types mentioned may be used to better advantage and judged and appreciated by the viewers with a better basis for understanding, it has been suggested that the *preliminary caption of the film should state whether the film is a research record or for instructional use.*

PLANNING THE FILM

Too much cannot be said for the careful planning of a film of an instructional⁸ nature before the actual shooting begins. For a clear,

⁸ All films that are to be viewed by anyone else except the maker are instructional in the sense that we have used the word here. It is sometimes useful to classify films into categories of research and instruction, but, as a matter of fact, a research film is simply a record like a protocol, and is most valuable to the research worker himself. One should not impose on his colleagues by reading to them all of his research; he would use samples, but the burden of his remarks would be interpretative. It is not good film technic nor even good manners to show monotonous repetitive sequences without interpretation presented either visually or orally.

accurate, and easily understandable portrayal of important facts, carefully designed continuity and sequence, and superior editing are essential. For an adequate consideration of these factors, the real purpose of the film should first be delineated. With this purpose definitely stated, the pertinent factors in the setup to be filmed should be prepared and arranged in the order in which they are to be portrayed. With these materials at hand and the purpose kept constantly in mind, the various shots should be carefully planned in such a way the eventual viewer of the film will be able to integrate easily all of the factors in the arrangement. At the same time the planner should make adequate use of the most important and illuminating technic that enough general views of the various setups may be had, so that available to the cinematographer—the close-up. *The beginner with the ciné camera errs most frequently in using too few close-ups.* The close-up is valuable in that it is useful in emphasizing details, in presenting easily recognizable portraits or pictures of people or apparatus, and in giving dramatic importance to a point. Parts of a frame on the screen that contain no action are wasted.

Careful advance planning eliminates unnecessary changing of camera positions with the resulting confusion that so often characterizes attempts of beginners in this type of work. A prime advantage of the "scenario" is that it divides the action of the picture into scenes that can be isolated so that all of the scenes calling for the position of the camera in one spot can be taken at one time regardless of the eventual edited continuity. It tells the cameraman exactly when it is necessary to take a new camera position. At each stage, he knows exactly what has been done and what remains to be done. Most departments of visual education or photography which make films for other departments are now insisting that the scenario be written and no deviation from it be allowed.

Even the "research film" that is designed accurately to report scientific research, like a good scientific paper, needs to be well organized. This usually means a considerable rearrangement of points and conclusions for purposes of clear exposition and convincing arrangement. No one would think of reading only his consecutive scientific protocols and counting that he had presented a successful, adequate paper. However, most films presented at our annual meetings in the past have revealed that the authors have contented themselves in showing the consecutive film shots in the chronological order in which they were taken, at considerable sacrifice of logical and artistic arrangement.

EDITING

After the picture has been photographed and the film developed, the process of editing and splicing is the final step. In the editing of the film its primary purpose should always be kept clearly to the fore. At this time it may seem advisable to depart from the original scenario in certain minor respects. For invariably in the shooting of a film, no matter how meticulous have been the arrangements and controls, some shots are going to be superior to others. As a consequence, it is quite likely that good editing will dictate elimination of certain sequences that were originally planned and that the film will be put together in the most logical and effective order that is apparent after the actual screen effect of the pictures is seen. In this way the continuity will be based on the actual material at hand, and the error of reading into the scenes something that is not there will be avoided. Beginners often fail to maintain high photographic standards at this point. They consider the expense of the film and often include scenes that are not up to the standard of the remaining film. *An economic concern at this point in production is a mistake.*

The next step is to clip off each scene with a pair of scissors, examine it, and write a brief description which will readily identify it without viewing it again. Make the description as impersonal and objective as possible. Read nothing into the scene which is not actually there. The essence of the pencil jottings should be brevity and directness, so that too much time is not consumed in this preliminary work.

After writing each scene description, the scene should be examined again so that it will be easy to connect the scene and the note. At this point a number of technics are open to the editor to aid in the ease of reassembling the various scenes in the proper sequence. In commercial work the use of "bins" and barrels seems to be preferred. A fiber barrel or a wood or metal bin of a convenient size, as a metal wastebasket, can be provided, into which is fitted a clean bag made of soft sheeting to protect the film from becoming scratched. Clips for holding the ends of the film may be attached to the edges of the container or to a rod placed across and above the top of the container. The film, with the scene description or number clipped to it or written on with a grease pencil, may then be fastened at one end to the clips provided and the loose ends allowed to drop into the bin. Where it is possible to complete the editing within a reasonably short time after the cutting, this procedure will be found to be the one most saving in time and effort.

There are those, however, who prefer to have their film strips in coils. Although this procedure is more satisfactory when the editing must be spread over a period of time, the rolling or coiling of the film strips can often become rather time-consuming. After the film is coiled it should be encircled with a rubber band, labeled, and then placed on small nails on a board, in egg boxes where the spaces for the eggs become pigeonholes, in pill boxes, in typewriter ribbon boxes, or grouped together in film "cans." Where it seems advisable to keep short scenes on file over a period of time, after they have been coiled, labeled, and banded, it has been found most satisfactory to store them together in the same type of film cans used to enclose regular motion picture reels. This will allow for storage of large amounts of short cuttings in a relatively small space.

The coiling of the short film strips is greatly facilitated through the use of "flanges." In appearance these look like the closed side camera reel with one of the sides removed. The film can be quickly slipped around the center and be wound with the flange placed on the regular rewind. If a stripping flange is obtained with a sliding center that will slide back to a point where it is flush with the side of the flange, the coil will simply drop into the editor's hand when the center is pushed out of the roll. Where it is not possible to obtain a commercially built spring flange a fair substitute can be easily devised in the laboratory. A regular closed side reel from a camera makes an acceptable flange with 1 side removed. Since the center cannot be made to slide back to allow easy removal of the film after the film is wound, it will be found that a short, quick turn of the rewind handle in the opposite direction will loosen the center of the coil and allow the film to be removed without great difficulty.

The film "horse" or "dummy" is a very simple piece of apparatus that speeds up the reeling of films that are not on reels as they come back from the developing laboratory or that have been previously coiled for filing. It consists of a small base with 2 vertical supports about 8" high, set wide enough apart to allow the film being used to fit freely between. Through the center of the supports at varying heights from the base are drilled holes to accommodate a rod, or small bar, which is left free and onto which the loose coils can be slipped. From this dummy reel the film can be quickly transferred to a regular reel on the rewind.

The adoption of some system is imperative in order to guard against the confusing litter of coiled and loose film on the work desk. With a system will come order, and with the order will come

increased efficiency through a knowledge of the exact stage in process, "knowing just where you are," which is the main secret of easy editing.

After the film has been cut up into the various scenes and the good shots have been filed and the bad shots have been set aside to avoid mixing, the way is prepared for the initial organization of the actual film for the preliminary reel. The strips should be spliced together in sequences and a continuity that will make them most effective in carrying through the central idea of the picture. After this has been done, the preliminary reel should be projected and careful notes made during the projection for any improvements or changes that can be made. Then the reel should be placed again on the rewind and gone over to remove inappropriate or poor shots still remaining, to relocate scenes in the film, or to insert any additional scenes which seem necessary for the smooth continuity of the picture.

It has been very wisely proposed that the scientific cinematographer, upon completing his "research" film, arrange for a private showing to his colleagues and friends to obtain criticisms and suggestions for improvement before putting his production in final shape for a larger audience. Invariably, the person who has taken the film feels that almost every foot of it is worth keeping. Too often, however, the enthusiastic producer rushes to the first scientific meeting that is held where he has a chance to display his work, with the result that the unfinished and disconnected nature of his work creates anything but the impression intended. Even the importance of the most noteworthy research can be nullified in the minds of observers who view a poorly directed and filmed motion picture presentation of the scientist's work.

Program committees demand abstracts of papers that are to be read at scientific sessions of regional and national association meetings. It has seemed worth while to guarantee a high grade of material and the elimination of objectionable material. *It would seem advisable to exercise equal care in reference to films that are presented on programs in psychology meetings.*

Psychologists, like other biologists, want their films to prove the point, and therefore may feel they need to repeat the scene enough times so that the spectator will not have any chance of thinking the response atypical or due to individual differences. *However, under ordinary circumstances, it would seem that 1 repetition would be enough.* This could be followed by a caption stating that what has been shown is typical. In the last analysis, *spectators are compelled*

to take the opinion and judgment of the person who has made up the film, just as we must where a scientific investigator presents a table of results.

Films Exhibiting Animal Subjects. Film editors should continually keep in mind the psychologist's code for animal experimentation⁹ and avoid giving offense to people who are sentimentally attached to and interested in animal life. Features in a scientific film which are likely to be somewhat repulsive to certain spectators should be as short as is consistent with the scientific materials to be portrayed. One general precaution in reference to animal films seems to be in place. They should avoid giving the impression of cruelty or unnecessary hurt. Frequently a caption might state that an anesthetic was used and due precaution taken to avoid pain and discomfiture. Frequently, the unhappy impression that some films give, and perhaps unnecessarily so, could be relieved by a final showing of the animal at play with the experimenter or with a child. Pure science need not be made to obliterate artistic tastes. Where animals or children or adult subjects are used, every effort should be made to demonstrate professional standards in the relation of experimenter and subject that are beyond criticism.

MECHANICS OF SPLICING

One of the first and most convenient accessories which will aid in making easy the mechanical part of the editing is a good rewind. It should consist of a firm base bearing at each end a spindle geared to a hand crank to support and rapidly revolve a reel of 400', or smaller, capacity. In purchasing a rewind, an essential feature to watch for is that both spindles are geared and allow for easy turning of the film in either direction, as is often necessary during the process of editing. Some of the geared rewinds are provided with brakes for quickly stopping the revolving reel at any point. Although this is an advantage, the braking can be quite easily done with the hand. One word of caution should be mentioned here. When a heavy reel nearly full of film is revolving rapidly and is then stopped suddenly, unless the other reel is stopped at the same time, the first will keep on revolving and run a quantity of film on the floor or in tangles on the desk. Always be sure to stop both reels at the same time.

Many of the rewind and splicing boards are supplied with a very

⁹ Most psychologists are not aware of the constant vigilance required to prevent sentimentalists from hampering research activities by sponsoring prohibitive legislation.

useful adjunct that makes for greater ease and speed in the editing process. This is an illuminated, magnifying, frame-by-frame viewing device, often spoken of as a magnifier, or viewer. With this, single frames may be viewed one by one with convenience and certainty, allowing for the accurate placing of titles and careful cutting of the film to show only certain operations of a performance if such is desired. The older type contained no intermittent drive, and as a consequence the film had to be stopped for viewing.

Just recently, magnifying viewers have been developed which will allow for viewing on the splicing stand while the film is in motion. These are built so that they may be run either forward or backward and may be stopped for the viewing of individual frames. They may be obtained with either a hand drive or a motor drive. The difference in cost between the motion viewer and the still viewer is so small that no one who is doing any appreciable amount of film editing can afford to be without a motion viewer.

The splicing operation itself is a simple one. In fact, the simpler and more rapid the movements to which it is reduced, the greater are the probabilities of obtaining a lasting splice. Making a good splice may be resolved into 4 operations: (1) cutting the film and cleaning the emulsion thoroughly from a suitable area, (2) applying the cement, (3) holding the splice under pressure, and (4) cleaning away the excess cement. The operation should be performed with a continuously accelerated tempo, ending with the speediest possible application of pressure to the film after the cement is applied. The first operation, cutting the film, is most conveniently and accurately done with the aid of the knife or cutter incorporated in the splicing machine. If the film is carefully placed on the index pins, the cut will always be correct. Next follows the scraping, which is perhaps the most important part of the operation. The film should be placed accurately in the scraping guide, and care should be taken to be certain that all the emulsion of picture surface at the point of the splice is thoroughly scraped away. Cement will not affect film covered with emulsion. Consequently, if there are any patches of emulsion left in the splice, it will result in a number of weak spots. Especial care should be taken to clean the film near its outer edges or around the sprocket holes, as it is here that the patch is most likely to first begin to weaken. Only 1 film of the two need be scraped, since the splicer so spaces the scraped area that a perfect overlapped joint is made if the operator follows directions. Care must be taken that the unscraped celluloid, or glossy surface of one film is in

contact with the scraped celluloid, or emulsion surface of the other. This will bring the emulsion sides of both films together.

After the film is scraped and completely cleaned of emulsion, it is placed on the registering pins. The cement is quickly spread on the scraped portion, the second piece of film is laid on it, and pressure is applied for a few seconds. Because of the fact that the film cement dries very rapidly, it is imperative that this operation be completed as rapidly as possible. A single stroke of the brush will deposit enough cement to fasten the film together. There should not be too much cement on the brush or it will flow on the film too fast and cause an overflow. This will gum the splicer and weaken the joint by softening the film adjoining the splice. Film cement is a solvent and not an adhesive. It melts the film pieces together and does not stick them together as an adhesive would. For this reason, care should be taken not to get cement outside of the area of the splice.

After removing the splice from the clamp, it should be examined. Uneven patches will show up plainly. If there are too many of them, it is best to ressplice. Sometimes the film will show a tendency to come apart at the edges. Usually a bit of cement carefully applied between the films will recement the edge when pressed between the fingers. The perforations should be clear and not filled with flakes of cement, nor should there be any "tails" of dried cement on the edges of the film. At all times, the fingers should be kept off of the picture area. Surplus cement should be removed with a clean, lintless cloth. With a properly made splice, there should be no cement showing after the clamp is removed.

TITLING

For general exhibition purposes titles should be copious enough for a clear explanation, worded in nontechnical language as far as possible, and should direct the observer's attention to the most significant feature portrayed in the shot. Titles can, however, overstep the mark and be too copious, resulting, in some cases, in a photographic presentation of a manuscript or a "screen paper" with a few illustrative pictures incidentally inserted.

In making titles, several methods are available. The first and easiest is to make use of the small compact title-making devices which provide an easel that holds a card, about 3" x 4", at the proper distance from the camera, the latter being attached to the base of the device and provided with an auxiliary lens to ensure that the camera lens shall always be in focus. Illumination of such small

title surfaces is relatively easy with the use of 2 Photoflood lamps held in efficient reflectors and placed 1 on each side. This amount of light will allow for the use of a fairly small stop, giving an increased sharpness to the final picture. Care should be taken to see that no direct light falls on the lens of the camera or on the auxiliary lens of the titler.

Whether or not the title will be effective depends largely upon the type of lettering that is used. A typewritten card is most unsatisfactory. A hand-lettered card is quite acceptable and can be very effective providing the lettering is skillfully done. A card set in suitable type is the best.

Another means of making titles is with the use of separate, larger-sized boards which have a nonreflecting, black background, made of felt or other absorbent material. Celluloid, paper, or the new raised block letters are affixed to such backgrounds by various means, after which the title is set up at the proper distance in front of the camera, illuminated, and photographed.

In all cases involving the use of a separate title board not held in fixed relationship to the camera, the problem of centering must be solved. The most efficient and practical solution to the problem of centering is through the use of a camera equipped with a reflex finder and focus. No other technique is so simple and will give such accurate results.

There are a number of ways of determining the relationship of the film to the title board in area before the final filming is done. The simplest method is to make use of a chart giving the size of field at varying distances from the camera. In the absence of the chart a mathematical relationship taken from it is useful in determining the width and height of various surfaces at varying distances from the camera. These relationships are based on a 16-mm. camera with 25-mm. lens, as follows:

Where:

W = width of included area

H = height of included area

x = distance from camera to title card

$$W = .385x$$

$$H = .293x$$

One final word of caution. The projector aperture is smaller than the camera aperture. For this reason, titles should never be too close to the edges, or there will be a danger of their being cut off

from the screen by the smaller projector aperture. It is always wise to keep the lettering together in a mass near the center of the title, leaving a generous margin completely around the edges of the title card.

In all cases involving the use of a separate title board not held in fixed relationship to the camera, not only must problems of auxiliary lens, lighting, lettering, and the relationship of the film to the title board in the area be considered, but the problem of centering must be solved. Many psychologists have come to the conclusion that titling is not their work, and they have their titles made by commercial firms. Some of these firms are:

Frederick F. Watson, 545 5th Avenue, New York City (Complete editing, cutting, and titling service)

Stahl Editing and Titling Service, successor to the Kodascope
Editing and Titling Service of the Eastman Kodak Company,
Room 1840, 33 West 42nd Street, New York City

Jack Miller, 1318 Powderhorn Terrace, Minneapolis, Minnesota
(Distinctive Titles)

PROJECTION EQUIPMENT

In order to do justice to the finished product and to obtain the utmost value from films, the purchase of a high-grade projector of sufficient power for the use to which it will be placed is essential. For school use, at least a 500-watt projector should be purchased. In most cases an even larger bulb is advisable because (1) greater power will enable one to have sufficient light for dark prints or to accommodate the occasional large audience, and (2) if the machine has a variable resistance and voltmeter, the life of the bulb can be materially increased by using it at less than the prescribed voltage. For example, a reduction of the voltage only 5% on a 1000-watt model will increase the life 100%, and a reduction of 10% will increase it 200%. Inasmuch as projection bulbs cost from \$6.25 to \$11 each, it may be seen that this arrangement has its economic value. If the occasion should demand, the full voltage may be placed on the lamp and high screen brilliancy obtained.

For most uses the standard 2" focal length lens is satisfactory. However, for projection distances of 50' to 100' it is necessary to use a 3" or 4" lens. Projection lenses are also assigned F-values. The lower the F-value, the greater the screen brilliance, other factors remaining constant.

With the regular 2" projection lens, the width of the screen picture is one-fifth of the throw (or projection distance). As an aid in determining the size of screen best suited to particular classroom situations and as an aid in determining the projection lens that will most adequately meet the requirements of a general school situation, the following table is given:

TABLE IV

	10'	15'	20'	25'	50'	75'	100'
	Width of Picture						
1" lens	3'9"	5'3"	7'6"	9'4"	18'9"		
2" lens	1'10"	2'9"	3'9"	4'8"	9'4"	14'0"	18'9"
3" lens	1'3"	1'9"	2'6"	3'1"	6'3"	9'4"	12'6"
4" lens	*	1'4"	1'10"	2'4"	4'8"	7'0"	9'4"

A power rewind saves many valuable minutes in rewinding films and is a definite requisite of a first-class projection machine.

The ease of threading the projector is of importance, inasmuch as many projectors are operated by students or inexperienced instructors. In this regard it might also be added that a small pilot light is a distinct advantage. Due to the fact that most projection is in a darkened room it is very difficult to thread the projector between reels without this auxiliary light unless the room lights are turned on each time. Pilot lights are built into some projectors and may be obtained as auxiliary equipment on others.

One other feature which should be required is an easily accessible aperture plate. This plate should be so constructed that it can be readily cleaned. Any dirt or dried emulsion which forms on the metallic surface must be removed, or the film will be scratched.

SUMMARY

To conclude, it might be well to reconsider briefly some of the more common errors in the production of film that are dealt with in the foregoing pages and cannot be overemphasized as to their effects upon the final outcome of the work of the laboratory cinematographer. These more common errors are:

1. Underexposure, resulting in films so dark that the picture cannot be seen clearly.
2. Overexposure, resulting in pictures that are thin and washed out, with very little detail.
3. Faulty lighting, or faulty exposure for the lighting at hand. The better films are made by lighting the action very brilliantly and stepping the lens down to compensate for the intensity. If a choice is offered between high illumination and small aperture, low illumination and wide-open lenses, always choose the former.

4. Out-of-focus or slightly blurred pictures, due to incorrect measurement of the distance from camera to subject. The probability of this error can be reduced by reducing the aperture as advised in (3).
5. Unsteady pictures, resulting from trying to hold the camera in the hand or from using a poor camera.
6. The omission of close-ups, resulting in monotony and loss of interest and wasted space.
7. Weak titles, or failure to make titles concise and full of valuable data.
8. Obscure sequences, the meaning of which is not made clear either by the action or by the title.
9. Sequences that are too long or too short.
10. Poorly composed scenes, including the inclusion of irrelevant material.

SOUND FILMS

There are 2 methods of obtaining a simultaneous auditory and visual presentation: the sound-on-disc method and the sound-on-film method. In the first method, the film is prepared in the usual way, and a disc recording is synchronized with the film. The method is cumbersome and impractical when one considers the necessity of editing not only the cineprint but also the wax sound record. It lends itself best to the recording of a synchronized commentary about the film after the latter is completely edited. This method was formerly used on theatrical 35-mm. films, but now has been completely superseded by the sound-on-film method. At the best, it is a makeshift arrangement; no user would long be satisfied with it.

Sound-on-Film. In 35-mm. film a portion of the projection frame has to be sacrificed in order to allow space for the sound track. But in the 16-mm. field it was found that it was possible to use perforations on only 1 side of the film, while the other side could be used for the sound track without invading the picture area. *All sound film is then perforated on only 1 side and as a consequence will be damaged beyond repair if an attempt is made to project it in a silent projector.¹⁰*

There are 2 methods of recording sound on film. One of these might be called the "single system," because the sound record is made on the original film at the same time the picture is exposed. The "double system" involves the use of a separate recorder and film for the sound alone, which is synchronized with the picture. Later, these 2 films are printed on *single* duplicate, which is projected in the usual fashion.

¹⁰ The sound projector, on the other hand, will accommodate silent film, since the mere presence of unused perforations presents no complication.

The direct method, although simpler in exposing originally, presents a serious handicap in editing. As is well known, the film in the camera has to be stationary for the small part of a second that it is exposed. This requirement has been met by the invention of the intermittent mechanism which moves the film very quickly from frame to frame, but this same mechanism prevents the uniform motion necessary for sound recording. Consequently, the recording galvanometer that exposes the film for the sound record is placed some 26 frames away from the camera aperture. The portion of the sound track that is directly beside any single frame is thus not synchronized with that particular frame, but with one 26 frames further on. This presents no difficulty in projection, since the photo-electric cell has the same relation to any frame that the recording galvanometer did in the first place, but, in editing, the editor always has to decide whether to sacrifice the sound track or the photograph. This makes for awkward transitions from scene to scene, whichever decision is made.

The "double system," on the other hand, allows one to edit the action and the sound separately, so that the transition can take place smoothly. Accidental occurrences, such as extraneous noises, can be removed from the sound track without affecting the action.

The "double system" does not cost twice as much to operate as might be supposed because twice the usual amount of film is used. The emulsion on the sound film can be very ordinary, so that its cost is about 1 cent a foot in comparison with the 6 to 9 cents a foot, which represents the cost of the various emulsions that we have described for photographic purposes.

On the other hand, the equipment necessary for sound production is expensive. In the case of either the single system or the double system the camera should be operated by a synchronous motor, because small variations in rate of exposure which are not detectable in a photograph will become immediately apparent in the reproduced sound track. In the double system the recorder and the camera have to be synchronized—an impossibility if one is operated by a spring motor. The outlay for microphone, amplifier, monitor, recorder, and camera would be approximately \$3000. In addition, some attempt to provide a soundproof and acoustically treated studio is essential.

In view of this fact, it would appear that the best arrangement at the present time would be the establishment of regional centers for the recording of sound on films that are prepared in the usual

silent fashion.¹¹ When special scenes in which the sound is an integral part and cannot be recorded afterward are required, either the sound camera should come to the subject, or better, the subject should be taken to the regional sound camera.

Films prepared for the post-recording of sound should be edited in the usual fashion and projected several times at the standard rate of 24 frames per second. Script is then prepared for each scene, its length related to the length of the scene length; the film and the script can then be sent together to commercial houses¹² that will, by using the double system, return a duplicate single film for projection. The preparation of the script itself is a long, tedious, and complicated job. Newsreels are usually prepared in this way. Newsreel commentators develop a skill in making their comments with the help of notes alone after several viewings of the film, but scientific films require less superficial observations than newsreel commentators make, so that a more careful preparation is required.

HOW TO TEST A USED CAMERA

When used cameras are bought they should be tested for the following points: (In practice, all of these tests can be combined into one 50' roll of film if the procedures are planned and rearranged beforehand.)

1. Part of the running mechanism may scratch the film. Load the camera with a short roll of fresh film and run 2' or 3' through the camera at different speeds. Take out these 2' or 3' and examine them on the emulsion side for scratches. Scratches near the sprocket holes do not matter, but even the faintest scratch in the picture area is enough to warrant rejecting the camera.

2. The camera should run evenly at the speeds indicated by the speed regulator. Load the camera with at least 50' of film, either new or used. To find out if it runs evenly at different speeds, listen to it while it is running. Any unevenness can be detected very easily by the fluctuations in the noise the camera makes. To find if the camera is running at the speed it is supposed to, take out the lens and make a pencil mark through the lens opening on the frame of film in the gate. Then, using a watch with a second hand, start the camera at zero seconds and stop it again at

¹¹ There is one difference. The exposures must be made at 24 frames a second instead of 16. Occasionally, a picture taken at 16 frames can be projected at 24 frames without jerkiness, but a better method is to take all pictures at 24 frames if there is the least possibility that commentary will ever be added later.

¹² The quality of the product of various organizations varies over a wide range. A sample should always be demanded, and payment for the service should be dependent on the similarity between the final product and the sample.

10 or 20 seconds. Then mark the frame of film that stopped in the gate, take the film out of the camera, and measure the length that ran through the camera in the elapsed 10 or 20 seconds. An easy computation, based on the speed at which the camera is set and the fact that 40 frames of 16-mm. film equal 1', will test the accuracy of the camera speed governor.

3. The camera manufacturer's manual for new cameras will specify how many feet of film the camera is supposed to run at 1 winding of the spring. Load the camera with 50' of film, wind the spring up tight, mark the frame you are starting on through the lens aperture (as in Test 2), run the camera until it stops because the spring is run down, mark the frame it stopped on, take the film out of the camera, and measure the film between the start and end marks. If the camera has a footage meter which is positively geared to the spring and is not dependent on a lever which rides on the spool of film, this footage indicator can be used in place of measuring the film by hand. The camera loaded with film should run practically as many feet of film through at 1 winding as a new camera and do this without beginning to slow down until very near the end of the run.

4. If the pull-down claw on the camera is worn it will not pull the film down into a perfectly centered position behind the lens in the film gate. The result is that the frame line on exposed film will not be exactly in the center of the sprocket holes. If such film with an imperfectly centered frame line is spliced in with film which has a properly centered frame line, the resulting projection print will have a varying frame line on the screen. This will mean that the projectionist continually must reframe the picture while it is running—a great inconvenience. It is much better to be sure that a camera has a reasonably well-centered frame line. To test this, simply thread the film in the gate, take out the lens, and with a sharp pencil mark the edges of the aperture on the film itself; then move the film 1 frame down and mark the second frame through the lens aperture as before. Now if the film is taken out of the gate and examined, it is easy to see if the picture is going to be accurately centered between 4 sprocket holes.

5. The take-up reel should take up evenly. To test this, simply load the camera and operate it with the camera door open. Watch the take-up reel to see if it operates smoothly or takes up jerkily.

6. Test the camera lens for focus by setting up three printed cards in the following way: One card should be set exactly at the point of focus indicated on the lens focus scale. The other 2 cards should be set some distance on the near and the far side of the first card. The developed film should show the first card in sharp focus and the other 2 cards slightly out of focus. This test should be made for at least 2 distances for each lens—for example, 6' and 20'. In addition, the focus on infinity can be tested by photographing distant tree branches against the sky. These focus tests should be examined with a good magnifying glass to determine the sharpness of the image.

7. Some lenses distort the picture at the edges of the frame. This fault can be tested by covering an area 6' x 8' on a wall with printed material varying in size from 1" to 3" high, and then photographing the whole setup. Again, examination of the exposed film with a magnifying glass will show whether or not the printed material appears sharp at the center of the picture and fuzzy at the edges, or sharp over the whole field. Most lenses will show a slight lack of definition at the edge of the picture, but it should not be very pronounced.

8. The lens should be very carefully examined for scratches. Many times amateurs will clean a lens with a cloth that is not perfectly clean, and sharp dust particles will leave scratches that tend to distort the picture. A very small scratch will probably not show, but if more than 1 is apparent it is safer to ask for another lens.

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NOTES AND NEWS

THE honorary degree of doctor of science was conferred upon Dr. Edmund S. Conklin, chairman of the department of psychology at Indiana University, by Clark University at its June, 1939, commencement.

PROFESSOR PAUL THOMAS YOUNG, of the University of Illinois, is spending his sabbatical year, 1939-1940, at Yale University, where he is working upon problems of attitude, interest, and emotion.

DR. CECIL W. MANN, formerly associate professor of psychology at Claremont Colleges, Claremont, California, is now professor of psychology at the University of Denver, Denver, Colorado.

DR. MARGARET F. WASHBURN, professor emeritus of psychology at Vassar College, died on October 29, 1939, in Poughkeepsie, New York.

Psychological issues: selected papers of Robert S. Woodworth, a volume prepared in commemoration of Professor Woodworth's seventieth birthday by his colleagues in the department of psychology at Columbia University, was published on November 14, 1939. It is a collection of some of Professor Woodworth's own most distinctive contributions, and includes not only his autobiography, but also a complete bibliography of his writings to date.

ON October 21 Indiana University conducted an all-day Symposium on Learning in celebration of the work of William Lowe Bryan and the inauguration of experimental work in psychology at that University in 1887. Professor Elmer K. Culler, of the University of Rochester, presented a paper on "Recent Studies of Learning by the Conditioned Response Method"; Professor John A. McGeoch, of the State University of Iowa, spoke on "The Pervasiveness of Learning"; and Professor W. N. Kellogg, of Indiana University, conducted a round-table discussion on learning. At the commemorative dinner President-emeritus Bryan told the story of his early years in psychological work. Representatives of many colleges and universities, including many former students, were present. Apparatus from the early days was on exhibition, including the first instrument (Hipp chronoscope) purchased by Dr. Bryan for the laboratory at Indiana University.

THE Executive Committee of the Research Council on Problems of Alcohol, an associated society of the American Association for the Advancement of Science, has inaugurated a broad program for attacking the disease of alcoholism and the alcoholic psychoses, based on research, which will be carried out until the end of 1941. Dr. Karl M. Bowman,

chairman of the Committee, has announced that grants of financial aid to the organization have been made by the Carnegie Corporation, the American Philosophical Society, and the Dazian Foundation for Medical Research. Three major measures will be employed: (1) the evaluation and coördination of existing research, (2) the development of a research program along lines inadequately investigated or not yet explored, (3) the dissemination of the results of such research. The long-range objective of the Council is "to discover the causes of alcoholism, and better methods for its prevention and treatment."

COPIES of "A Symposium on Color Tolerance," a report of the technical session of the 1939 annual meeting of the Inter-Society Color Council, may be obtained as long as the supply lasts by sending 50 cents to Inter-Society Color Council, P. O. Box 155, Benjamin Franklin Station, Washington, D. C.

PROFESSOR FORREST A. KINGSBURY has been appointed secretary of the department of psychology at the University of Chicago and, since the resignation of Professor Frank N. Freeman to become dean of the School of Education at the University of California, is acting as the executive officer of the department.

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